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AEC REPORT ON INDEMNITY ACT AND ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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CONGRESS OF THE UNITED STATES

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FOREWORD

The Joint Committee on Atomic Energy has scheduled public hearings on April 29 and 30, 1959, on liability and indemnity problems, the Advisory Committee on Reactor Safeguards, and reactor site selection. International and maritime liability problems will be included. In order to assist the members of the Joint Committee and other persons to prepare for these hearings, the Joint Committee is publishing this print. It includes a copy of a letter dated April 8, 1959, from the AEC, forwarding two proposed amendments to the act with respect to liability and indemnity, and a report prepared by AEC on indemnity and liability problems, as required by section 170 of the Atomic Energy Act of 1954.

The Commission and members of the Advisory Committee on Reactor Safeguards will testify concerning these subjects on the afternoon of April 29 and representatives of industry and the public on the following day, April 30.

It is hoped that these materials, prepared and distributed in advance of the hearings, will be of assistance to the members of the Joint Committee, the AEC, industry and the public.

CLINTON P. ANDERSON, *Chairman.*

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AEC REPORT ON INDEMNITY ACT AND ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

U.S. Atomic Energy Commission,
Washington 25, D.C.

Hon. Clinton P. Anderson,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

Dear Senator Anderson: There is attached a proposed bill to amend section 170 of the Atomic Energy Act of 1954, as amended. The proposed bill contains two amendments. The first of these is designed to exclude from Commission coverage any liability for damage to property which is at the site of and is used in connection with the licensed activity. Such property is hereinafter referred to as on-site property. The proposed amendment would not affect indemnity agreements which the Commission enters into with its contractors.

The phraseology of the Price-Anderson Act seems clearly to require that the Commission's indemnity coverage include indemnity against any legal liability arising out of a nuclear incident, including liability for damage to on-site property. The relevant provision of the Price-Anderson Act is section 11u. of the Atomic Energy Act of 1954, as amended. This subsection provides that:

> u. The term "public liability" means any legal liability arising out of or resulting from a nuclear incident, except claims under State or Federal Workmen's Compensation Acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs, and except for claims arising out of an act of war. "Public liability" also includes damage to property of persons indemnified: *Provided*, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs.

The first sentence clearly covers any legal liability arising out of a nuclear incident except for claims under Workmen's Compensation Acts of on-site employees, and claims arising out of an act of war. There is no exception for claims for damage to on-site property. In other words, where a person is legally liable for the nuclear incident and for damage to on-site property, such as the reactor, such person would be indemnified under this sentence against his liability for damage to on-site as well as other property.

The second sentence provides coverage for damage to the property of persons legally liable for the nuclear incident except "property which is located at the site of and used in connection with the activity where the nuclear incident occurs." Thus, the sentence provides coverage for property damage which would not otherwise be indemnified because a person cannot be liable to himself for damage to his own property. The exception contained in the second sentence does not appear to apply, however, to claims covered by the first sentence

of the definition. The proposed amendment would add such an exception to the first sentence of the definition, but limit its applicability to indemnity agreements entered into with licensees. It would exclude from Price-Anderson agreements entered into with licensees coverage of "property which is located at the site of and used in connection with" the licensed activity.

Coverage of liability for damage to on-site property diminishes the $500 million indemnity protection available to the general public under the Commission's indemnity agreements. There does not appear to have been, nor does it appear likely that there will arise any need for, Government coverage of on-site property. Commercial insurance for such property is available up to $60 million.

Second proposed amendment.—The nuclear energy liability insurance policies offered by the Nuclear Energy Liability Insurance Association and mutual atomic energy liability underwriters insurance syndicates contain an aggregate-limit-of-liability provision. The face value of the policies is not automatically reinstated after payment of claims. Because of the absence of an automatic reinstatement provision, payments by the insurer under the policy, in the event of a nuclear incident, might under the existing provisions of the act result in a gap in the financial protection furnished by the licensee until the insurers reinstate or other appropriate steps are taken.

The proposed amendment is intended to permit the Commission to fill this gap for a reasonable period of time until the insurers have had reasonable opportunity to reinstate or the licensee has had opportunity to furnish the protection in some other form. The proposed amendment includes a floor of $1 million, below which the Commission would have no obligation.

Sincerely yours,

JOHN A. MCCONE, *Chairman.*

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That:

Subsection 11 u. of the Atomic Energy Act of 1954, as amended, is amended to read as follows:

"u. The term 'public liability' means any legal liability arising out of or resulting from a nuclear incident, except: (i) claims under State or Federal Workmen's Compensation Acts of employees or persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs; (ii) claims arising out of an act of war; and (iii), whenever used in subsections 170 a., c. and k., claims for loss of, or damage to, or loss of use of property which is located at the site of and used in connection with the licensed activity where the nuclear incident occurs. 'Public liability' also includes damage to property of persons indemnified: *Provided,* That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs."

SEC. 2. The following sentence is added at the end of subsection 170 c. of the Atomic Energy Act of 1954:

"Where the amount of financial protection maintained by the licensee in the form of liability insurance is reduced by reason of payment by the insurer of claims or costs of investigating and settling claims and defending suits for damage, the Commission may indemnify and hold harmless the licensee and other persons indemnified, as their interest may appear, from public liability in excess of the remaining financial protection or one million dollars, whichever is higher, arising from nuclear incidents occurring prior to the payment of such claims or costs or during such period of time, not to exceed 90 days, following such payment as the Commission determines will afford reasonable opportunity to furnish financial protection in the amount required."

U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C., REPORT TO THE JOINT COMMITTEE ON ATOMIC ENERGY ON OPERATIONS UNDER SECTION 170 OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, MARCH 31, 1959

This report on the operations of the Atomic Energy Commission under the indemnity program is submitted pursuant to section 170i. of the Atomic Energy Act of 1954, as amended. The report covers the indemnification of activities licensed by AEC, indemnification of activities conducted under contracts with the Commission, and international and maritime indemnity. It also includes a summary of the operation of the Advisory Committee on Reactor Safeguards and public licensing hearings held by the Commission.

PART I. INDEMNIFICATION OF LICENSEES

Revision of financial protection requirements

A comprehensive revision of the Commission's regulation on financial protection requirements (10 CFR pt. 140) is currently under consideration. The revision will be published in the Federal Register as a notice of proposed rulemaking and will reflect comments received from interested persons, discussions with industry advisory groups, and experience gained since issuance of the temporary regulations and publication of the Commission's annual indemnity report to the Joint Committee, dated March 28, 1958.

The principal matters under consideration include:

(*a*) A revision of the method for determining the amounts of financial protection required, particularly to take into account population density surrounding reactor sites;

(*b*) A financial protection requirement for holders of reactor construction permits who are authorized to possess and store special nuclear material, in the form of reactor fuel, at their reactor sites prior to receipt of a reactor operating license;

(*c*) Provisions exempting Federal agencies and nonprofit educational institutions from the financial protection requirement; and

(*d*) Requirements as to the information which must be furnished the Commission by licensees choosing to rely on their own resources as proof of financial protection.

Proposed regulations approving the form of nuclear energy liability insurance policies and commission indemnity agreements

Beginning shortly after enactment of Public Law 85–256, extensive discussions were held between representatives of the Atomic Energy Commission and the nuclear energy liability insurance syndicates concerning the draft form of nuclear energy liability insurance policy under consideration by the syndicates. In these discussions attention was focused primarily on drafting and coverage questions in an effort to assure that the policy would accomplish the purposes and meet the requirements of Public Law 85-256.

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A form of liability insurance policy was submitted to the Commission by the insurance syndicates. On August 28, 1958, this form was published by the Commission in the Federal Register for public comment. At the same time the Commission published a proposed form of Government indemnity agreement for public comment. Copies of these two documents were furnished the Joint Committee on August 26, 1958. The published policy form represented the most recent draft then available and is the form which has been filed by the insurance industry with the various State insurance agencies. It is also the form which has been incorporated in binders filed by licensees as proof of financial protection.

The policy form.—In September 1958, the syndicates submitted a proposed further revision of the policy forms to the Commission. The principal change which would be effected by this revision is to provide increased coverage in the event of a "common occurrence" as defined in the policies. Under the form of policy published on August 28, 1958, the total aggregate liability of each of the insurance syndicates under all applicable policies was limited, in the event of a common occurrence, to the highest applicable limit of liability of any one policy. Under the more recent draft policy the total aggregate liability of the companies is limited by the sum of the limit of liability of all of the applicable policies provided that the total liability of the companies may not exceed $46.5 million in the case of policies issued by the Nuclear Energy Liability Insurance Association or $13.5 million in the case of policies issued by the Mutual Atomic Energy Liability Underwriters. A copy of the proposed form of policy received in September 1958 is attached as appendix A.

Since receipt of the revised draft, further discussions have been held with the insurance syndicates and it is anticipated that a number of additional changes may be made in the policy. These changes are discussed below.

Licensees subject to the financial protection requirements of section 170 of the act are required to furnish financial protection for public liability arising out of a nuclear incident. Above the amount of financial protection, the Commission furnishes indemnity protection in the amount of $500 million. The financial protection furnished by licensees and the indemnity protection furnished by the Commission should meet as closely as possible in order to avoid any gaps between the two. While to a very substantial extent, this objective has been accomplished, there remain some unresolved problems discussed below.

Gaps might exist if the scope of coverage of financial protection is not as broad as the Commission's indemnity coverage; or if the amount of financial protection furnished is lower than the level at which the Commission's indemnity obligation becomes effective. At present there still remain a number of such gaps as indicated below:

(*a*) The insurance policies cover nuclear incidents occurring at a facility or in the course of transportation of source, byproduct, or special nuclear material shipped from the facility; but they do not cover transportation to the facility unless the shipment is from a facility owned by the United States. Since the indemnity protection afforded by the Commission includes transportation to a covered facility, regardless of whether the shipment is made from a Government owned facility, there may be a gap in insurance coverage when a shipment to the facility is made from a privately owned plant.

It appears that this gap may be eliminated. The insurance syndicates have advised that they are considering revision of the policies to cover shipments to a covered facility from privately owned plants as well as Government owned plants.

(*b*) The nuclear liability insurance policies offered by the Nuclear Energy Liability Insurance Association and Mutual Atomic Energy Liability Underwriters insurance syndicates contain an aggregate-limit-of-liability provision. The face value of the policies is not automatically reinstated after payment of claims. The syndicates claim that the aggregate limit of liability is necessary to provide firm limits on the amount of money at risk under any one policy and to avoid situations in which the liabilities of the syndicates might exceed their pool capacities. Because of the absence of an automatic reinstatement provision, payments by the insurer under the policy, in the event of a nuclear incident, would result in a "gap" in the financial protection furnished by the licensee until the insurers reinstate or other appropriate steps are taken. The Commission, therefore, recommends amendment of section 170 of the act. The proposed amendment is described below.

(*c*) Gaps may also arise because of the common occurrence provision in the policies. This provision provides that:

LIMITATION OF LIABILITY: COMMON OCCURRENCE

Any occurrence or series of occurrences resulting in bodily injury or property damage arising out of the radioactive, toxic, explosive, or other hazardous properties of source material, special nuclear material or byproduct material—

(*a*) in the course of transportation from the facility or to the facility from a nuclear facility owned by the United States of America and also arising out of such properties of other such material in the course of transportation from one or more other nuclear facilities or to one or more such facilities from one or more nuclear facilities owned by the United States of America, or

(*b*) discharged or dispersed from the facility over a period of days, weeks, months or longer and also arising out of such properties of other such material so discharged or dispersed from one or more other nuclear facilities,

shall be deemed to be one nuclear incident.

With respect to such bodily injury and property damage (1) the total aggregate liability of the companies under all Nuclear Energy Liability Policies (Facility Form), including this policy, applicable to such incident shall be the sum of the limits of liability of all such policies, the limit of liability of each such policy being as determined by Condition 3 thereof, but in no event shall such total aggregate liability of the companies exceed $46,500,000;[1] (2) the total liability of the companies under this policy shall not exceed that proportion of the total aggregate liability of the companies, as stated in clause (1) above, which (*a*) the limit of liability of this policy, as determined by Condition 3, bears to (*b*) the sum of the limits of liability of all such policies issued by the companies, the limit of liability of each such policy being as determined by Condition 3 thereof.

The provisions of this condition shall not operate to increase the limit of the companies' liability under this policy.

The Commission believes that the possible gaps resulting from the "common occurrence" provision may be avoided in part by revising the indemnity agreements published by the Commission on August 28, 1958, to include a "common occurrence" provision. Such a revision is under study.

The proposed form of insurance policy also provides that:

This policy applies only to bodily injury or property damage (1) which results from nuclear incidents occurring during the policy period and (2) which is discovered, and for which written claim is made against the insured, not later than two years *after the end of the policy period.* [Italic supplied.]

[1] Policies issued by the Nuclear Energy Liability Insurance Association provide $46.5 million; policies issued by Mutual Atomic Energy Liability Underwriters provide $13.5 million.

We are concerned that, if the insurers exercise their right to cancel the policy, this 2-year provision may result in exclusion from coverage of a significant portion of the insured's liability. Such concern has particular significance in connection with radiation injuries because such injuries may not become evident until substantial periods after exposure has occurred. The syndicates have furnished the Commission with a statement of their reasons for including this provision and a copy of that statement is attached as appendix B.

The form of insurance policy also contains the following provision:

> If a representative of the companies discovers a condition with respect to the nuclear energy hazard which he believes to be unduly dangerous, a representative of the companies may request that such condition be corrected without delay. In the event of noncompliance with such request, a representative of the companies may, after twelve hours prior notice to the United States Atomic Energy Commission, by written notice to the named insured, immediately suspend the insurance with respect to the named insured and any other person or organization responsible for the continuance of such dangerous condition.

We believe that 12 hours' notice to the Commission is too short and would not furnish the Commission with opportunity to take appropriate action. The syndicates have advised that they are preparing a revision of the policies to make the suspension effective at the close of the next normal working day following the day on which notice of intent to suspend the policy is received by the Commission. This proposed revision would also provide for automatic termination of the suspension when the unsafe condition has been corrected. Such a revision should go far to eliminate the principal problems presented by the original 12-hour suspension provision.

The proposed indemnity agreement.—Substantial public comments on the proposed form of indemnity agreement have also been received. The principal matters discussed in these comments, which are not dealt with elsewhere in this report, include the following:

(*a*) Paragraphs 5 and 6 of article II of the proposed indemnity agreement set forth the obligations of licensees under section 53 e. (8) of the Atomic Energy Act of 1954, as amended. Section 53 e. (8), applicable to special nuclear material licensees, provides that:

> (8) except to the extent that the indemnification and limitation of liability provisions of section 170 apply, the licensee will hold the United States and the Commission harmless from any damages resulting from the use or possession of special nuclear material by the licensee.

Comments have been received questioning the Commission's conclusion that licensees subject to the financial protection requirements of section 170 remain subject to subsection 53 e. (8) up to the amount of financial protection.

The comments also suggest a need for clarification of the scope of licensees' obligations under subsection 53 e. (8). These comments include questions as to whether the subsection covers damage to Government property, Government liability to third persons, or both; and whether the subsection applies to cases where the Government may have been at fault. The need for clarification of the subsection is under study. It should be noted, however, that liability of licensees under subsection 53 e. (8), whatever its scope, is within the coverage of the syndicates' nuclear energy liability insurance policies.

(*b*) Several suggestions were received that the indemnity agreements and financial protection requirements be effective as of the date fuel elements are transported to the reactor site, if such date

precedes the issuance of the reactor operating license. These comments are being considered in connection with the present study of revision of financial protection requirements.

(*c*) Comments suggest that the insurers and the Commission further coordinate their claims settlement procedures. These matters are presently under study by the Commission and the syndicates.

(*d*) The suggestion has been made that a bankruptcy and insolvency clause similar to that found in most insurance policies and in the syndicate policies be included in the indemnity agreement. Under such a provision, the bankruptcy or insolvency of a person indemnified would not relieve the Commission or the licensee of its indemnity obligations. The inclusion of such a provision in the agreement is under study.

Legislative proposals

Proposed amendments to the indemnity provisions of the act will be submitted to the Congress. The first proposed amendment would exclude from Commission indemnity coverage any liability for damage to property which is located at the site of, and used in connection with, the licensed activity.

The nuclear energy liability policy offered by the syndicates does not provide for automatic reinstatement of the policy limit upon payment by the insurers of claims resulting from a nuclear incident. Hence, before reinstatement, such payments may produce a "gap," with respect to other nuclear incidents, between the remaining coverage afforded by the policy and the level at which the Commission's indemnity obligation commences. A second proposed amendment would authorize the Commission to fill this "gap" for a reasonable period of time which would afford the licensee opportunity to furnish financial protection in the required amount, subject to a floor of $1 million.

Administration of licensee indemnity

The Commission has tendered a short form interim indemnity agreement to each of its reactor licensees who are required to furnish proof of financial protection. The interim agreement, in essence a restatement of the appropriate provisions of the Price-Anderson Act, provides that it will be superseded by the formal indemnity agreement when the latter is issued in final form.

Of the 13 nonexempt research and industrial organizations operating reactors, 12 have furnished nuclear energy liability insurance binders as proof of financial protection and 1 is relying on his own financial resources to satisfy third party liability claims. The minimum amount of financial protection ($250,000) is required of all but two of these licensees; the exceptions are the licensees authorized to operate a 3-megawatt research reactor and a 50-megawatt power reactor, who, under the current $150,000 per megawatt provision, must maintain $450,000 and $7,500,000 of protection, respectively.

A total of 17 educational institutions currently hold licenses authorizing them to operate a nuclear reactor. All have either qualified or appear to be eligible for exemption from the financial protection requirements. However, seven have nuclear energy liability insurance coverage in effect.

Materials licensees

As a part of its continuing study of the problem of extending indemnity to materials licensees, the Commission has entered into a contract for a study of criticality hazards. The study is, in part, intended to furnish information needed for a decision as to whether or not subsection 170 a. should be applied to persons licensed under section 53 of the act to use and possess special nuclear material. The Commission understands that many organizations which possess and use licensed materials have purchased nuclear energy liability insurance.

PART II. INDEMNIFICATION OF ACTIVITIES CONDUCTED UNDER CONTRACT WITH THE COMMISSION

As reported last year, under authority contained in section 170 d. of the Atomic Energy Act of 1954, as amended by Public Law 85–256, 85th Congress, the Commission adopted a policy of entering into agreements of indemnification extending the statutory indemnity—

(*a*) to AEC contractors engaged in the operation of nuclear reactors;

(*b*) to AEC contractors engaged in operating production or utilization facilities;

(*c*) to AEC construction contractors whose work may place them under the risk of occurrence of a substantial nuclear incident;

(*d*) subject to authorization by the General Manager, to any other AEC contractors, other than those specified in (*a*), (*b*), and (*c*), who engage in activities involving the risk of occurrence of a substantial nuclear incident.

In carrying out this policy the Commission has executed statutory indemnity agreements as to 33 contracts. These agreements cover most of the major AEC installations operated by AEC contractors. Included in these contracts is an agreement with the railroad associations covering nuclear incidents arising in the course of transportation of materials for the Commission.

To date there have been no claims filed under the statutory indemnity and consequently no expenditure of money.

The insurance industry has made its claims adjusting service available, if needed, in the area of statutory indemnity for either AEC licensees or AEC contractors. Definitive agreements outlining the details of these arrangements are being negotiated by groups representing various segments of the insurance industry.

PART III. MARITIME INDEMNITY PROBLEMS

Certainly one of the more complex and time-consuming portions of the Commission's indemnity program is that associated with the international operation of merchant ships. While the immediate indemnity problems associated with the NS *Savannah* were to a great extent resolved by the passage of Public Law 85–602, it was specifically noted that this legislation was not to be considered as precedent setting for later nuclear merchant ships.

Under Public Law 85–602, the Commission was—

> authorized to enter into an agreement of indemnification with any person engaged in the design, development, construction, repair, and maintenance or use of the nuclear powered ship authorized by section 716 of the Merchant Marine Act of 1936 and designated as the nuclear ship *Savannah*.

In recognition of the fact that the United States cannot unilaterally resolve the maritime indemnity problems nor in fact can the Commission alone reach conclusive recommendations, a joint task group is at work to identify and recommend solutions to the legal, insurance, and liability problems of the *Savannah* and subsequent nuclear ships.

Since early 1957, the Commission and the Maritime Administration have worked closely with the underwriters, principally through the American Institute of Marine Underwriters and NELIA, on a basis under which we can secure insurance for the NS *Savannah* in order to establish a pattern for future privately owned nuclear ships. It now appears that the two groups can provide insurance, though it will vary from the normal marine insurance practices and from the pattern established for land-based nuclear installations. Of principal concern to insurance underwriters is the pyramiding of liability and the effect of modifying the admiralty concept of limited liability. Among other things, the on-site and off-site concept under section 170 of the Atomic Energy Act of 1954, as amended, cannot be applied to a nuclear ship. Also the crew of a ship is not subject to a workmen's compensation system, but in admiralty law are treated very much the same as third parties.

This task group will also work out an approach to international arrangements to facilitate acceptable indemnity provisions for nuclear ships within existing international agreements or, if necessary, seek resolution of these problems through new arrangements.

International interest in third-party liability has been shown by the association of maritime lawyers, known as the Comite Maritime International, and several national maritime law associations of Western Europe. One of these has recently circulated a questionnaire to all Western European associations and the American Maritime Law Association with a view toward amendment of shipowner's liability conventions. The urgent problems here are the possibility of establishing absolute liability for nuclear damage and the establishment of a reasonable limit of indemnification on the part of underwriters and the Government. Some pattern has been set for action on nuclear ship liability and indemnity amendments by the action of the OEEC with respect to land-based installations and the transportation of nuclear materials.

Obviously there are admiralty laws and insurance practices which will require some modifications to facilitate the advent of nuclear power to the world's merchant marine. It is expected that clarifying information will be forthcoming in the next few months that will indicate the kind of legislative action that is necessary.

PART IV. FOREIGN LIABILITY PROBLEMS

Significant efforts are being made to solve the foreign and maritime third-party liability problems through the use of international conventions. The OEEC group of experts was scheduled to meet again in March 1959, in Paris, to attempt to put into final form the provisions of the OEEC draft third-party liability convention. After being put into final form and approved by the European Nuclear Energy Agency, the proposed convention may then be submitted to governments for appropriate government consideration and ratification. The six Euratom countries are in addition drafting their own

convention, apparently intended to supplement that of the OEEC, and which would establish a limitation of liability at a level substantially higher than the level established by the OEEC draft convention.

At the request of the OEEC, the International Maritime Committee, on which the shipping industries of all major maritime countries are represented, has prepared and submitted a report on the maritime aspects of third-party liability. In addition it has drafted, for inclusion in the OEEC draft convention, suggested provisions to regulate such liability.

The International Atomic Energy Agency convened a panel of experts to consider the third party liability problem. The Associate General Counsel of the Atomic Energy Commission was designated U.S. representative to this panel and attended its first meeting recently concluded in Vienna.

Insofar as practicable, representatives of interested agencies of the U.S. Government (e.g., AEC; State Department; Maritime Administration) have attended foreign meetings on this subject so as to be of greatest possible assistance to the foreign representatives, and further the interests of the U.S. Government.

Although no foreign government has to date actually enacted legislation comparable to the Price-Anderson amendment, at least three foreign governments—United Kingdom, West Germany, and Switzerland—are considering proposed legislation relevant to the third party liability problem. The coverage afforded is different in each case, but there is no indication of discrimination against American suppliers in any of the porposed pieces of legislation. It appears likely that some of this proposed legislation will be acted upon this year, and that Japan and some Latin American countries will become increasingly interested in solving the problem.

As has been previously reported, our efforts have been directed primarily toward encouraging and supporting fully efforts of foreign governments to enact their own legislation and effect international arrangements. However, we are continuing to explore not only possible solutions open to foreign governments, but also possible steps the U.S. Government may take in the event that foreign governments fail to solve the problem. In this regard, we are studying carefully such studies as the "Financial Protection Against Atomic Hazards; the International Aspects" under the auspices of Harvard Law School and Atomic Industrial Forum, Inc., and "Non-Technical Problems of Nuclear Merchant Ships" of the University of Michigan Research Institute under contract with the U.S. Department of Commerce.

PART V. OPERATIONS OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

This part of the report summarizes the operations of the Commission's Advisory Committee on Reactor Safeguards since January 1958.

As provided in section 182 b. of the Atomic Energy Act of 1954, as amended, all license applications for power and testing reactors are required to be reviewed by the Advisory Committee. In addition, the Commission obtains the Committee's advice on the nuclear safety aspects of all major reactor projects constructed or operated under contracts with and for the account of the Commission or which are constructed or operated for the Department of Defense.

Since January 1958, the Advisory Committee has held 11 meetings each of 2 to 3 days duration. One of these was held at Hanford to consider the desirability, from a public safety standpoint, of the release of the secondary zone of the Wahluke Slope. All other meetings were held in Washington. In the course of its meetings, the Committee reviewed and rendered advice to the Commission on the safety aspects of 8 reactor projects subject to licensing and 23 AEC and Department of Defense projects. Copies of the Committee's reports on these cases, except those involving classified projects, are attached hereto in appendixes C, D, and E and cover projects subject to licensing. AEC-owned reactors and Department of Defense reactors, respectively. The status of each of the projects reported on is described below:

Reactor projects subject to licensing

The following power and test reactor projects are subject to licensing. The safety evaluation of such projects is performed by the Commission's technical staff and each project is referred to the Advisory Committee on Reactor Safeguards for review and advice. The staff analyses and the reports of the ACRS are published in the Commission's public document room. Before issuance of a construction permit or operating license, a public hearing is held in accordance with section 189 of the act.

Carolinas Virginia nuclear powerplant.—Before the Commission entered into a contract with the Carolinas Virginia nuclear power group under the third round of the power demonstration program, the proposed site of the 60 Mw (thermal) contained heavy water moderated reactor was discussed with the ACRS. Committee views are contained in appendix C–1. The company has been informed that the status of the company-owned village of Parr, S.C., which comprises some 70 people and is located inside the boundary of the proposed site will be decided prior to plant startup. Final judgment on this point has been reserved. This facility will be privately owned and will be subject to licensing in accordance with the usual procedures for commercial facilities.

Consolidated Edison Co.—In 1956 the Consolidated Edison Co. of New York, Inc., was granted a permit to construct a 585-thermal Mw. nuclear powerplant at Indian Point, N.Y. The pressurized water reactor in this plant will be a thorium converter so designed as to produce on the average one-half atom of the fissionable nuclide U^{233} for every atom of U^{235} consumed. The steam produced by the nuclear plant will be superheated in an oil-fired plant. The capacity of the facility is estimated to be 275 Mw. of electrical power.

During the year 1958 the company filed amendments to its application giving additional information on the design of containment structures for the plant and requesting approval for this design. On the basis of advice from the ACRS (app. C–2) consideration is now being given to the issuance of an amendment to the construction permit to approve the design of the containment structures.

Review of the final hazards summary report will be conducted by the ACRS when available, and a public hearing will be held prior to operation.

Westinghouse testing reactor (WTR).—On July 3, 1957, the AEC issued a construction permit to Westinghouse Electric Corp. author-

izing the corporation to build a 20,000-kilowatt (thermal) testing reactor at Waltz Mill, Westmoreland County, Pa.

On November 7, 1958, the Advisory Committee on Reactor Safeguards reviewed data submitted by the corporation in connection with its request for a license to operate this facility. In its report dated November 12, 1958, the committee concluded that the WTR can be operated without undue hazard to the health and safety of the public. (See app. C–3.)

In accordance with the requirements of the Atomic Energy Act, notice of hearing was issued on February 16, 1959, setting the matter down for hearing on the question of the issuance of an operating license. The hearing was held on March 25, 1959. No petitions to intervene were filed. The hearing examiner set April 10, 1959, as the date by which the applicant and AEC staff are to file proposed findings and conclusions for his consideration.

Commonwealth Edison Co. (Dresden nuclear power station).—A construction permit was issued May 4, 1956 to Commonwealth Edison Co., Chicago, Ill., authorizing construction of a developmental power reactor at its Dresden station located in Grundy County, Ill. The facility authorized for construction is a dual-cycle boiling-water-type reactor designed to furnish 180,000 kilowatts of electricity. Construction is scheduled for completion in August 1959. The permit was amended on March 31, 1958, to incorporate as a technical specification the design of the containment vessel described in the application, as amended, after review by the ACRS. (See app. C–4.)

On October 16, 1958, the Advisory Committee on Reactor Safeguards reviewed amendments submitted by the applicant comprising portions of the final hazards summary report for this facility. In its report dated October 21, 1958, the committee stated that it does not see any problems of concern relating to the possible hazards of the Dresden nuclear power station, but deferred a more detailed report until a later date. (See app. C–5.) Amendments Nos. 3 and 4 comprising additional technical data were forwarded to the ACRS on January 22, 1959, and February 11, 1959. This information was considered at its March meeting and a report from the committee is pending. Upon completion of ACRS review this matter will be set down for public hearing on the question of issuance of an operating license.

Yankee Atomic Electric Co.—On November 4, 1957, the Commission issued a construction permit to Yankee Atomic Electric Co., Boston, Mass., authorizing the company to build a pressurized light water-moderated and cooled nuclear power reactor at Rowe, Mass.

On October 15, 1958, the Advisory Committee on Reactor Safeguards reviewed data submitted by the company in connection with its request for approval of (1) an alternative method for determining the effects of plutonium buildup on the nuclear characteristics and stability of this reactor, and (2) the waste disposal facilities planned for the Rowe plant. In its report dated October 21, 1958, the committee concurred generally with Yankee's proposals. (See app. C–6, 9.) Some additional data by the applicant on this and other matters will require further discussion with the committee. Construction of this facility is proceeding. Meanwhile, additional information and plans for operation must be submitted by the applicant in a final

Hazards report, and this must be evaluated by the staff and the ACRS. A public hearing will be held prior to operation.

General Electric Co. Vallecitos boiling water reactor (VBWR).—On August 31, 1957, the Atomic Energy Commission issued a license authorizing General Electric Co. to operate at power levels up to 20 megawatts (thermal) its light water-moderated and cooled boiling water reactor located in Alameda County, Calif., approximately 33 miles east-southeast of San Francisco.

At its meeting held on March 6–7, 1958, the Advisory Committee on Reactor Safeguards reviewed data submitted by the company in connection with its request for amendments to its license which would (1) authorize changes in fuel loading, (2) increase the allowable operating thermal power when using a mixed core to 30 megawatts and (3) authorize heating of the reactor from cold to operating temperature by nuclear heat instead of by externally supplied heat. In its report dated March 8, 1958, the committee concluded that it saw no significant hazards increase in these proposed activities provided that any rod-type elements in the core would be, as uniformly as possible, surrounded by plate-type elements. The committee recommended that the possibility of a cold-water type of accident be further studied and any modifications of control systems or operating procedures found necessary be made before resuming operation. (See app. C–10.)

The committee's recommendations were covered by conditions included in a proposed amendment to license DPR–1 published in the Federal Register on April 19, 1958. No request for formal hearing being filed, amendment No. 3 covering these operations was issued on May 3, 1958.

At its meeting held on August 4, 1958, the Advisory Committee on Reactor Safeguards reviewed data submitted by the company (in amendment request No. 24 and related documents) supporting its request for an amendment which would revise and broaden its authorization under license DPR–1. Based on advice from the ACRS (see app. C–11, 12) and on AEC staff study, approval of the requested authorization with certain operating and procedural limitations was incorporated by the Commission in the proposed amendment No. 9 to license DPR–1 which was published in the Federal Register on January 14, 1959. No request for formal hearing having been filed, amendment No. 9 was issued on January 30, 1959.

General Electric testing reactor (GETR).—On March 11, 1958, a construction permit was issued to the General Electric Co., San Jose, Calif., authorizing construction of a 33,000-kilowatt (thermal) light-water cooled and moderated testing reactor at the company's Vallecitos atomic laboratory in Alameda County, Calif.

In its eighth meeting on July 10–12, 1958, the Advisory Committee on Reactor Safeguards reviewed data submitted by the General Electric Co. in support of the company's application to AEC for a license to operate the facility. In a report dated July 12, 1958, the committee informed the AEC that, in its opinion, the GETR may be operated as a testing reactor as proposed by the General Electric Co. without undue hazard to the public. (See app. C–13.)

On August 13, 1958, the AEC published a notice setting this matter down for hearing, in accordance with the provisions of section 189 of the 1954 act, as amended. The hearing was held on September 17,

1958. No petitions to intervene were filed. The hearing examiner issued an intermediate decision on December 16, 1958, which ordered, subject to the right of review by the Commission, that the operating license be issued to the General Electric Co. upon completion of a satisfactory final inspection of the facility by the AEC and upon submission of proof by the company that the required financial protection coverage had been placed in effect.

It having been determined by the AEC that the facility had been constructed substantially in accordance with the terms and conditions of the construction permit and that the required financial protection coverage had been obtained, the Commission on January 7, 1959, issued the license to General Electric Co. authorizing operation of the facility. The plan is now in operation.

Massachusetts Institute of Technology.—The Massachusetts Institute of Technology was authorized under a construction permit issued by the AEC on May 7, 1956, to construct a 1,000-kilowatt (thermal) heavy-water moderated research and medical reactor on its campus at Cambridge, Mass.

In a report dated January 13, 1958, the Advisory Committee on Reactor Safeguards furnished the AEC the Committee's opinion that the MIT reactor can be operated with an acceptable degree of risk to the health and safety of the public. The Committee recommended that provision be made for an auxiliary system of closing the inlet and outlet lines of the ventilation system. (See app. C–14, 15.) Subsequently, the institute advised the Commission that it would provide an adequate manually operated valve to be auxiliary to the automatically controlled valve already installed.

On March 31, 1958, the AEC issued a notice of proposed issuance of facility license. This notice, which was published in the Federal Register on April 4, 1958, provided that in the absence of the receipt within 30 days of a request for a hearing, the license would be issued authorizing operation of the reactor. No request for hearing was received and the license was issued on June 9, 1958, after completion of an AEC inspection to determine that the facility had been constructed in accordance with the terms and conditions of the construction permit. The reactor is now in operation.

National Aeronautics and Space Administration.—The Commission's first annual report to the Joint Committee, dated March 28, 1958, described the status of the NASA reactor (formerly the National Advisory Committee for Aeronautics), as follows:

> On September 4, 1957, a notice of hearing was issued on this matter, setting October 8, 1957, as the date for hearing. A prehearing conference was held on September 27, 1957, and the AEC Counsel requested a postponement of the hearing until the report of the ACRS had been published. Pursuant to this request, the hearing examiner issued an order postponing the hearing to a date to be thereinafter determined.
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> An amendment to the original notice of hearing in this matter dated September 6, 1957, provided that the hearing examiner should certify the record of the hearing to the Commission for its decision without the hearing examiner rendering an intermediate decision. The Commission subsequently modified this by an order dated December 5 in which the hearing examiner was directed to render an initial decision in this matter.
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> On November 29, 1957, the Commission issued a notice stating that a report of the ACRS and a hazards analysis by the AEC staff on this matter were available in the Commission's public document room.[2] The examiner thereafter

[2] A copy of the ACRS report is attached as app. C–16, 17.

published an order setting January 16, 1958, as the date for hearing. A prehearing conference was held on January 6, 1958. The hearing was concluded on February 21, 1958, and the parties are presently preparing findings and conclusions to be submitted to the examiner. There was no intervention in this matter. However, there was an informal appearance by Dr. Ralph Dwork, director of health, State of Ohio, in accordance with section 2.731 of the Commission's rules of practice.

Following completion of the formal hearing on February 21, 1958, the hearing examiner issued his intermediate decision on June 24, 1958, and ordered that unless exceptions were filed on or before July 18, 1958, or unless the Commission reviewed the examiner's decision on its own motion, the application for a construction permit be granted, effective July 21, 1958.

On June 30, 1958, the applicant moved that (1) the period for filing exceptions and Commission review be waived, (2) the intermediate decision become final immediately, and (3) the amended application for the construction permit be granted immediately. On July 10, 1958, the Commission denied the applicant's motion described above and, at the end of the 20-day period allowed for filing exceptions, permitted the examiner's decision to become final. The Commission issued the construction permit on July 21, 1958.

Commission-owned reactors

The safety evaluation of these projects follows the same procedures as for projects subject to licensing, except that the cases involving military prototype reactors and reactors located on Commission-owned sites are not set down for formal public hearing. Under present Commission policy, described later in this report, the public will be afforded opportunity, through formal hearings, to participate in the safety review and to present their views relating to Commission-owned reactors in the power reactor demonstration program.

Nuclear merchant ship (NS "Savannah").—The construction of the nuclear powerplant, hull, and fittings of the NS *Savannah* is underway. The ACRS and Commission staff are presently engaged in a review of the detailed design of the powerplant and the ship as it has been developed by the contractor. An interim report on the design of the nuclear propulsion plant by the ACRS is included as appendix D–1, 3. Further reviews on design and a study of the operation will be conducted by the ACRS as additional information is developed.

Small submarine reactor prototype (SIC).—The design and proposed operating procedures for the prototype small submarine reactor located near Windsor, Conn., was reviewed by the ACRS prior to its operation. The committee's comments are contained in appendix D–4. This Commission-owned reactor was built under the naval reactor program as a prototype for a reactor to be installed in a new class of submarines, and as a training facility for operating personnel.

City of Piqua power reactor.—The Piqua organic moderated reactor is included in the second round of the power reactor demonstration program, with an objective of demonstrating the feasibility of the organic moderated concept. Steam will be furnished to an existing power station. The design power is 45.4 thermal microwatts; organic material (Santowax-R) functions both as coolant and moderator. Another organic reactor, the 16 MW OMRE, in operation at NRTS

since September 1957 has supplied much of the design information for the Piqua reactor.

The Piqua reactor has been discussed with the ACRS on five occasions. The resulting action is summarized as follows:

1. As originally proposed the facility did not incorporate conventional low-leakage containment and was sited on the west bank of the Great Miami River, within 200 feet of the nearest private residence. Following its August 1958 meeting the ACRS expressed the tentative opinion that the site was not suitable. (See app. D–7.)

2. The project was discussed again with the ACRS at the October 1958 meeting. The Committee reaffirmed its previous position that the site was unacceptable. (See app. D–6.)

3. Representatives of AI and the city of Piqua appeared before the Committee at its November 1958 meeting with oral proposals for a new location approximately one-fourth mile east across the river from the original site. Although the Committee was favorably impressed, the preliminary nature of the information presented was insufficient for any firm conclusions. (See app. D–6.) This site was subsequently found to be unavailable to the city.

4. At the December 1958 meeting a third site, on the east bank of the river and about 750 feet from the nearest residence, was discussed briefly with the ACRS. In addition, several facility changes were proposed to enhance the safety of the reactor. No judgment resulted from this meeting.

5. The site described in paragraph 4 was reviewed by the Committee on a formal basis at the January 1959 meeting. The findings were that this site appeared more favorable than the site originally proposed. However, the Committee did not consider installation of the facility at this location without undue public hazard unless more substantial and dependable containment were furnished. (See app. D–5.)

The Piqua facility is currently undergoing redesign in order to comply with the most recent opinion of the ACRS. The new design will be referred to the Committee.

Rural Cooperative Power Association reactor (*Elk River*).—The Rural Cooperative Power Association in cooperation with the Commission is constructing a boiling water power reactor with an ultimate power level of 116 Mw (thermal) near Elk River, Minn., under the Commission's power reactor demonstration program. As a result of a review of the proposed site by the Commission staff and the ACRS (app. D–8, 12), RCPA has undertaken the purchase or control of additional land adjacent to the site. The reactor will be housed in a low-leakage high-integrity containment building, and appropriate reliable emergency systems will be installed to prevent core meltdown under any credible circumstances. A public hearing will be held after a forthcoming ACRS and Commission review of the proposed detailed design of the reactor.

Plutonium recycle test reactor (*PRTR*).—The plutonium recycle test reactor is a 70 Mw (thermal) heavy water cooled and moderated experimental reactor being built by the Commission on the Hanford, Wash., reservation. The reactor vessel is of a pressure tube type which facilitates changing of the plutonium alloy fuel elements. The purpose of the reactor is to explore the feasibility of a reactor which generates its own fuel from fertile material alloyed into its fuel elements. The proposed design of the reactor and its containment

were reviewed by the ACRS, whose views are contained in appendix D–13, 14. Plans have been revised to include their suggestions. Construction of the reactor is now underway. It will be reviewed again by the Committee before operation.

Heavy water component test reactor (*HWCTR*).—This reactor is intended to serve as a test facility for natural uranium fuel elements. The reactor will operate at 60 Mw with heavy water under a pressure of 1,000 pounds per square inch serving as moderator and coolant. Containment is provided. The site proposed is in the northwest sector of the Savannah River plant, 3 miles from the nearest boundary. The project was reviewed by the ACRS at the October and November 1958 meetings, with respect to the suitability of the site. The Committee recommended approval of the site, and the reactor is now under design. Design features will be referred to the Committee for review (app. D–15).

SPERT III is a heterogeneous light water-cooled and moderated reactor, designed for operation at pressures up to 2,500 psi and temperatures up to 670° F. This facility at the National Reactor Test Station will be used for the performance of basic reactor kinetics studies designed to provide information for the advancement of pressurized waterpower reactor safety and technology. The facility is in a remote location as a protective measure against possible accidental releases of radioactivity.

The study of the hazards connected with SPERT III indicated that to avoid a chance exposure of persons to radiation some of the more hazardous experiments should be conducted only when favorable meteorological conditions prevail. The ACRS concurred with the AEC staff that the facility could be operated without undue hazard, and the reactor was subsequently started up in December 1958. (See app. D–16.) At present the series of low power, static tests of the reactor are nearing completion in preparation for further performance tests, which will be conducted at powers up to the maximum rated level of 60 megawatts.

Materials testing reactor (*MTR*).—The Commission-owned materials testing reactor at the National Reactor Testing Station was designed and is used primarily for determining radiation effects on new fuel elements and other reactor components. These fuel elements and components are tested by placing them in various loops in and around the reactor core, normally made up of highly enriched uranium fuel elements. The MTR is also used as an experimental tool in determining the feasibility and practicality of the use of different fuel material for the reactor core. Two such loadings, a plutonium loading and a loading of uranium 233, were reviewed by the ACRS before use in the MTR core. (See app. D–17, 18.) The plutonium loading has been successfully carried out, and the U–233 loading is scheduled in the future.

Aircraft carrier reactor prototype (*A1W*).—The A1W project is a pressurized water prototype for the reactor plant under design for the aircraft carrier. Location of the AlW is at NRTS. It consists of two reactors operating to supply a single turbine drive of a simulated ship shaft. The two reactors have a number of dissimilar features. Containment is not provided. The project was reviewed by the ACRS at the July 1958 meeting and received a favorable

recommendation. The Committee request for further review as the project progresses refers to facilities to be built later in this program. The plant has been completed and is now in operation. (See app. D–19, 20.)

Brookhaven National Laboratory research reactor (BNL).—As a result of the Windscale incident of October 1957, during which a release of radioactivity occurred when an attempt was made to anneal the graphite in the reactor, a detailed review of the procedures to be followed in the next scheduled annealing of the graphite moderated BNL research reactor was conducted by the Commission and the ACRS (app. D–21, 22). There were no unexpected occurrences in the subsequent annealing of the graphite moderator of the BNL reactor.

Oak Ridge research reactor (ORR).—Prior to the startup of the Oak Ridge research reactor, the final design and proposed operating procedures and limitations were reviewed by the ACRS (app. D–23, 24). The ORR is an MTR-type testing reactor of 20 megawatt nominal power level which is owned by the Commission, and located at Oak Ridge National Laboratory. It provides additional capacity to that of the Commission's materials and engineering testing reactor (MTR and ETR) utilized for irradiation testing of new reactor fuel elements and components. The ORR successfully passed through startup and low power tests and is now in full operation.

Advanced submarine reactor prototype (S3G).—The S3G land-based prototype submarine powerplant was constructed at the West Milton, N.Y. laboratory of the General Electric Co. The entire plant, including the water cooled and moderated reactor, is contained in a section of a submarine hull which has been suitably modified to serve as a containment vessel for the system. This single reactor system is the prototype of a dual reactor powerplant (S4G) for the submarine *Triton*. The reactor is now in operation.

In May 1958 the project was reviewed by the ACRS, who expressed a favorable opinion on this facility. (See app. D–25, 26.)

Argonne low power reactor (ALPR).—The ALPR is intended to serve as a combination electrical power and space heating facility for applications in isolated arctic areas. The reactor thermal output is 2 megawatts, with a net electrical output of 200 kilowatts, and an equivalent of 400 kilowatts of space heating. Location of the ALPR is at NRTS. The project was considered by the ACRS at the March 1958 meeting. The favorable opinion of the ACRS is attached as appendix D–27. Construction was subsequently completed and the reactor is now in operation.

Experimental breeder reactor (EBR–II).—The EBR–II is a Commission-owned, fast, sodium-cooled, experimental reactor located at the National Reactor Testing Station in Idaho. Its design power level is 62.5 megawatts (thermal), and its purpose is to develop information and experience pertinent to the operation of fast breeder power reactors. The reactor and facility design was reviewed by the ACRS (see app. D–28) who reported favorably on proposed plans. Construction is now underway in Idaho.

Wahluke Slope.—The Wahluke Slope is located across the Columbia River from the Hanford reactors. That part under AEC control was composed of a primary and secondary zone, with a minimum distance of approximately 5 miles from the production reactors to the nearest

boundary of the secondary zone. Previous ACRS advice had been to retain control of both primary and secondary zones subject to periodic review of their status. Upon request of the Commission, the ACRS in 1958 reviewed the Wahluke Slope problem. (See app. D–29, 32.) After completion of this review, the Commission on December 30, 1958, announced that its objection to irrigation development of the 105,500-acre secondary zone of the Wahluke Slope had been withdrawn.

Parallel procedures on AEC-owned reactors

With respect to certain Commission-owned reactors which are not subject to licensing, the Commission has recently established a policy to provide for public participation in the review of safety considerations. The reactors to be covered by the new policy will be those not located at Commission-owed installations and which are to be operated as part of conventional electric utility systems.[3] The procedures under which the public will be enabled to participate will parallel those followed in licensing proceedings. Under these parallel procedures copies of the contractors' hazards summary reports, the reports of the Advisory Committee on Reactor Safeguards and the analysis prepared by the Division of Licensing and Regulation will be made available to the public. In addition, each project will be set down for public hearing after due notice to the public. Appropriate amendments to the Commission's rules to formalize this policy are being prepared.

Department of Defense reactor projects

Under a policy statement agreed upon by the Department of Defense and the Commission in November 1954, the Department's military power reactor projects are referred to the Commission for evaluation of safety. In the course of the evaluation, the projects are referred to the ACRS for review and advice.

"Triton" propulsion plant (S4G).—The S4G is a dual reactor powerplant designed and built for submarine propulsion. As in its S3G prototype, the reactors in this plant are moderated and cooled by pressurized water.

Prior to the startup of this plant in the submarine *Triton*, the ACRS reviewed the design of the S4G and reported its opinion that the plant could be operated without undue hazard to the health and safety of the public other than that possibly introduced by unusual fleet operations. (See app. E–1.)

Lockheed radiation effects reactor (RER).—The RER is a Department of the Air Force reactor designed and operated for the purpose of determining radiation effects on large scale aircraft components and systems. The 10 megawatt water moderated and cooled reactor is located near Dawsonville, Ga., on a 10,000-acre site with an exclusion radius of over 1½ miles. The ACRS and the Commission staff reviewed the safety of operating this reactor as requested by the DOD before reactor startup. (App. E–2, 3.)

The committee identified two areas of concern in the operation of this facility. In subsequent studies and discussions, the AEC staff reached agreement with the operators of this ANP project for limited operation at low power under carefully controlled conditions to permit

[3] The reactors currently affected by this policy are the consumers public power district project and reactor projects in the second round of the power reactor demonstration program.

measurements of air and dust activation in the nearby area. When these data have been collected, detailed study will be given to the safety implications of the results and discussion with the ACRS will be held before power is increased. The reactor has been operating since December 1958 at levels up to 1 megawatt.

"Skipjack" propulsion plant (S5W).—S5W is the pressurized water reactor powerplant designed for use in a series of submarines which will be constructed at different shipyards. The design of this plant has evolved from the earlier nuclear submarine plants. Much experience relevant to the safety of reactors of this type has been gained through the operation of nuclear submarines and test facilities.

The ACRS in reviewing this case commented on the risk in the operation of any nuclear submarines which is derived from the possibility of release of radioactive material. However, the ACRS expressed the opinion that the *Skipjack* series of powerplants probably represents an improvement in safety over previous designs (appendix E–4, 5).

The S5W powerplant has been installed in the submarine *Skipjack*, which is now in operation.

In response to the recommendations of the ACRS for long-range studies of environmental problems the Navy and the AEC are studying ways in which their existing programs in meteorological research might be modified to better serve the requirements for safety in the nuclear navy. A similar approach is being contemplated to augment the Navy's oceanographic research program.

"Skate" and follow ships propulsion plants (S3W).—The *Skate* is the first submarine in which the S3W powerplant was intalled. This pressurized water reactor has subsequently been installed in four submarines. The ACRS report is attached as appendix E–6, 7

Other activities

In addition to the cases referred to it for formal review and advice, the ACRS is kept informed by the Commission staff of actions taken on small research and training reactors which, because they pose no significant safety problems, are not referred to the Committee; copies of hazards summary reports on these cases are sent to the Committee. These and other actions taken by the staff are routinely reported to the Committee at its regular meetings.

Staff briefings of the Committee have been conducted as a useful means of keeping the Committee abreast of current developments in the Commission's reactor safety research programs. Among the subjects presented during the past year were discussions of reactor safety research programs, including fission product release experiments, safety fuse devices, and containment studies.

Admiral Rickover gave a presentation at the November 1958 meeting on experiences in reactor design, construction, testing, and operation. Briefings were also given by the staff on the criteria being used for selection of a suitable base for testing nuclear-powered aircraft, the status of design studies on such proposed projects as the gas-cooled reactor, the Florida Nuclear Power Group reactor, the Philadelphia Electric Co. project, and the new production reactor.

The Division of Inspection also briefs the Committee at each meeting on the results of current inspections of reactor facilities.

In addition to the foregoing, the staff presentations covered the fuel-handling accident at Chalk River in May, the criticality accident at Oak Ridge in June, the HTRE accident at Idaho in November, and the criticality accident at Los Alamos in December 1958.

Aside from specific reactor projects referred to the Advisory Committee, the Commission also obtains the Committee's advice on matters of general significance and applicability in the field of reactor safety. In this connection, and as a part of the Commission's plan to develop and prescribe more specific reactor safety standards and criteria in its regulations, the Committee now has under review proposed criteria developed by the Commission staff for site selection, control rod design, control system design, and external containment structures. A special subcommittee has been established by the Committee to consider the criteria for site selection.

Membership and organization of the Advisory Committee

During 1958, four new members were added by the Commission to the Advisory Committee. They are Dr. Franklin A. Gifford, Jr., meteorologist in charge, Weather Bureau Office; Dr. Henry W. Newson, professor of physics, Duke University; Dr. Leslie Silverman, associate professor of industrial hygiene engineering, Harvard University School of Public Health; and Dr. Charles R. Williams, assistant vice president, Liberty Mutual Insurance Co.

Two of the original 10 members, Dr. Mark Mills and Dr. Manson Benedict, resigned because of the press of other responsibilities. At present, three positions on the Committee remain unfilled. In line with the Commission's policy, appointments to these positions will be made with a view to assuring the staggering of terms of members and to add such additional specialities as appear desirable. The following is the present roster of the Committee:

Dr. C. Rogers McCullough, chairman, project specialist, Monsanto Chemical Co.
Dr. Willard P. Conner, Jr., vice chairman, manager, physical chemical division, research department, Hercules Powder Co.
Dr. Harvey Brooks, dean of engineering and applied physics, Harvard University.
Dr. R. L. Doan, manager, Atomic Energy Division, Phillips Petroleum Co.
Dr. Franklin A. Gifford, Jr., meteorologist in charge, Oak Ridge office, U.S. Weather Bureau.
Dr. Henry W. Newson, professor of physics, Duke University.
Kenneth R. Osborn, manager of industrial development, General Chemical Division, Allied Chemical Corp.
D. A. Rogers, manager, central engineering, Allied Chemical Corp.
Dr. Leslie Silverman, professor of engineering in environmental hygiene, director of radiological hygiene program, Harvard University School of Public Health.
Col. Reuel C. Stratton, assistant director, department of research, the Travelers Insurance Co.
Dr. Charles R. Williams, assistant vice president, Liberty Mutual Insurance Co.
Dr. Abel Wolman, head, Department of Sanitary Engineering, Johns Hopkins University.

APPENDIX A

NUCLEAR ENERGY LIABILITY POLICY (FACILITY FORM)

The undersigned members of _____ _____ hereinafter called the "companies," each for itself, severally and not jointly, and in the respective proportions hereinafter set forth, agree with the insured, named in the declarations made a part hereof, in consideration of the premium and in reliance upon the statements in the declarations and subject to the limit of liability, exclusions, conditions, and other terms of this policy:

INSURING AGREEMENTS

I. Coverage A—Bodily injury and property damage liability

To pay on behalf of the insured—

(1) all sums which the insured shall become legally obligated to pay as damages because of bodily injury or property damage caused by the nuclear energy hazard, and the companies shall defend any suit against the insured alleging such bodily injury or property damage and seeking damages which are payable under the terms of this policy; but the companies may make such investigation, negotiation, and settlement of any claim or suit as they deem expedient;

(2) costs taxed against the insured in any such suit and interest on any judgment therein;

(3) premiums on appeal bonds and on bonds to release attachments in any such suit, but without obligation to apply for or furnish such bonds;

(4) reasonable expenses, other than loss of earnings, incurred by the insured at the companies' request.

Coverage B—Damage to property of an insured away from the facility

With respect to property damage caused by the nuclear energy hazard to property of an insured which is away from the facility, to pay to such insured those sums which such insured would have been legally obligated to pay as damages therefor, had such property belonged to another.

Coverage C—Subrogation—Offsite employees

With respect to bodily injury sustained by any employee of an insured and resulting from a nuclear incident, to pay to the workmen's compensation carrier of such insured all sums which such carrier would have been entitled to recover and retain as damages from another person or organization, had such person or organization alone been legally responsible for such nuclear incident, by reason of the rights acquired by subrogation by reason of the payment of the benefits required of such carrier under the applicable workmen's compensation or occupational disease law. An employer who is a duly qualified self-insurer under such law shall be deemed to be a workmen's compensation carrier within the meaning of this coverage. This coverage C does not apply to bodily injury sustained by any person who is employed at and in connection with the facility. This coverage C shall not constitute workmen's compensation insurance as required under the laws of any State.

II. Definition of insured

The unqualified word "insured" includes (*a*) the named insured and (*b*) any other person or organization with respect to his legal responsibility for a nuclear incident.

Subdivision (*b*) above does not include as an insured the United States of America or any of its agencies.

Subject to condition 3 and the other provisions of this policy, the insurance applies separately to each insured against whom claim is made or suit is brought.

III. Definitions

Wherever used in this policy:

A. the term "bodily injury" means bodily injury, sickness or disease, including death resulting therefrom, sustained by any person;

B. the term "property damage" means physical injury to or destruction or radioactive contamination of property, and loss of use of property so injured, destroyed or contaminated, and loss of use of property while evacuated or withdrawn from use because possibly so contaminated or because of imminent danger of such contamination;

C. the term "the facility" means the facility described in the declarations and includes the location designated in item 3 of the declarations and all property and operations at such location;

D. the terms "source material," "special nuclear material," and "byproduct material" shall have the meanings given them in the Atomic Energy Act of 1954, or in any law amendatory thereof;

E. the term "nuclear energy hazard" means the radioactive, toxic, explosive or other hazardous properties of source material, special nuclear material or byproduct material, but only with respect to (1) the possession, handling, use or disposal of such materials at the location designated in item 3 of the declarations, or (2) the transportation, including handling or temporary storage incidental thereto, of such materials shipped (*a*) from such location, provided such transportation of such materials shall be deemed to end when such materials are removed from a transporting conveyance for any purpose other than continuation of such transportation or temporary storage incidental thereto, or (*b*) to such location from a nuclear facility owned by the United States of America, provided such transportation of such materials from such nuclear facility is not by predetermination to be interrupted by the removal of such materials from a transporting conveyance for any purpose other than the continuation of such transportation to such location or temporary storage incidental thereto;

F. the term "nuclear incident" means an occurrence which results in bodily injury or property damage caused by the nuclear energy hazard;

G. the term "nuclear facility" means "the facility" as defined in any nuclear energy liability policy (facility form) issued by the companies or by the----------.[1] The term "nuclear facility" also means:

(1) any apparatus designed or used to sustain nuclear fission in a self-supporting chain reaction or to contain a critical mass of fissionable material;

(2) any equipment or device (*a*) designed or used for the separation of the isotopes of uranium or plutonium, (*b*) designed or used for the processing, fabricating or alloying of special nuclear material, (*c*) designed or used for the processing of irradiated materials containing special nuclear material or incorporating or making use of such irradiated materials, or (*d*) designed or used for processing waste consisting of or containing byproduct material;

(3) any structure, basin, excavation, premises or place prepared or used for the storage or disposal of waste consisting of or containing byproduct material;

and includes the site on which any of the foregoing is located, together with all operations conducted thereon and all premises used for such operations.

Subdivision (*b*) of paragraph (2) foregoing is not applicable to (1) the occasional mechanical processing or fabricating of special nuclear material by any person or organization at a location which contains no equipment, device or apparatus otherwise defined herein as a nuclear facility, where special nuclear material or byproduct material is not regularly handled, stored, or disposed of as waste, and which is principally used for other operations not related to the handling, fabricating or use of special nuclear material, or (2) the processing, fabricating, alloying or storing of special nuclear material at a location which contains no equipment, device or apparatus otherwise defined herein as a nuclear facility and where the total amount of special nuclear material being processed, fabricated, alloyed or stored does not consist of or contain at any time more than 200 grams of uranium 235 or uranium 233, or any combination thereof, or more than 10 grams of plutonium.

IV. Application of policy

This policy applies only to bodily injury or property damage (1) which results from nuclear incidents occurring during the policy period and (2) which is discovered, and for which written claim is made against the insured, not later than 2 years after the end of the policy period.

EXCLUSIONS

This policy does not apply:

(*a*) to any obligation for which the insured or any carrier as his insurer may be held liable under any workmen's compensation, unemployment compensation or disability benefits law, or under any similar law;

[1] Mutual Atomic Energy Liability Underwriters or Nuclear Liability Insurance Association, as appropriate.

(*b*) except with respect to liability of another assumed by the insured under contract, to bodily injury to any employee of the insured arising out of and in the course of his employment by the insured; but this exclusion does not apply to any person who is not employed at and in connection with the facility if the insured has complied with the requirements of the applicable workmen's compensation or occupational disease law respecting the securing of compensation benefits thereunder to his employees;

(*c*) to liability assumed by the insured under contract, other than an assumption in a contract with another of the liability of any person or organization which would be imposed by law on such person or organization in the absence of an express assumption of liability;

(*d*) to bodily injury or property damage due to the manufacturing, handling or use at the location designated in item 3 of the declarations, in time of peace or war, of any nuclear weapon or other instrument of war utilizing special nuclear material or byproduct material;

(*e*) to bodily injury or property damage due to war, whether or not declared, civil war, insurrection, rebellion, or revolution, or to any act or condition incident to any of the foregoing;

(*f*) to property damage to any property at the location designated in item 3 of the declarations, other than aircraft, watercraft, or vehicles licensed for highway use, provided such aircraft, watercraft, or vehicles are not used in connection with the operation of the facility;

(*g*) to property damage to source material, special nuclear material or byproduct material in the course of transportation to or from the location designated in item 3 of the declarations, including handling or storage incidental thereto;

(*h*) to any nuclear incident—

(1) arising out of the possession, transportation, handling, use or disposal, outside the territorial limits of the United States of America, its Territories or possessions, Puerto Rico or the Canal Zone, of source material, special nuclear material or byproduct material;

(2) occuring at any nuclear facility other than the facility described in the declarations;

(3) arising out of the possession, transportation, handling, use or disposal by any person or organization, away from the facility, of source material, special nuclear material or byproduct material, unless such nuclear incident occurs away from any other nuclear facility and in the course of transportation, including handling or storage incidental thereto, of source material, special nuclear material, byproduct material contained in or combined with special nuclear material, or waste consisting of or containing byproduct material, shipped (i) from the facility or (ii) to the facility from a nuclear facility owned by the United States of America;

(*i*) under coverage B, to property damage due to neglect of the insured to use all reasonable means to save and preserve the property after knowledge of a nuclear incident.

CONDITIONS

1. Premium

The named insured shall pay the companies the advance premium stated in the declarations, for the period from the effective date of this policy through December 31 following. Thereafter, at the beginning of each calendar year while this policy is in force, the named insured shall pay the advance premium for such year to the companies. The advance premium for each calendar year shall be stated in a written notice given by the companies to the named insured as soon as practicable prior to or after the beginning of such year.

Such advance premiums are estimated premiums only. As soon as practicable after each December 31 and after the termination of this policy, the earned premium for the preceding premium period shall be computed in accordance with the companies' rules, rates, rating plans, premiums and minimum premiums applicable to this insurance. If the earned premium thus computed for any premium period exceeds the advance premium previously paid for such period, the insured shall pay the excess to the companies; if less, the companies shall return to the insured the unearned portion paid by the insured.

The named insured shall maintain records of the information necessary for premium computation and shall send copies of such records to the companies at the end of each calendar year, at the end of the policy period and at such other times during the policy period as the companies may direct.

2. Inspection: Suspension

The companies shall be permitted to inspect the facility and to examine the insured's books and records at any time, as far as they relate to the subject matter of this insurance.

If a representative of the companies discovers a condition which he believes to be unduly dangerous with respect to the nuclear energy hazard, a representative of the companies may request that such condition be corrected without delay. In the event of noncompliance with such request, a representative of the companies may, after 12 hours' prior notice to the U.S. Atomic Energy Commission, by written notice to the named insured, immediately suspend the insurance with respect to the named insured and any other person or organization responsible for the continuance of such dangerous condition. A copy of such notice shall be sent promptly to the U.S. Atomic Energy Commission. The insurance so suspended may be reinstated by the companies by an endorsement issued to form a part of this policy.

3. Limit of liability: Termination of policy upon exhaustion of limit

Regardless of the number of persons and organizations who are insureds under this policy, and regardless of the number of claims made and suits brought against any or all insureds because of one or more nuclear incidents during the policy period, the limit of the companies' liability stated in the declarations is the total liability of the companies for their obligations under this policy and the expenses incurred by the companies in connection with such obligations, including—

(*a*) payments in settlement of claims and in satisfaction of judgments against the insureds for damages because of bodily injury or property damage, and payments made under parts (2), (3), and (4) of coverage A, and payments made in settlement of claims under coverages B and C;

(*b*) payments for expenses incurred in the investigation, negotiation, settlement and defense of any claim or suit, including, but not limited to, the cost of such services by salaried employees of the companies, fees and expenses of independent adjusters, attorneys' fees and disbursements, expenses for expert testimony, inspection and appraisal of property, examination, X-ray or autopsy or medical expenses of any kind:

(*c*) payments for expenses incurred by the companies in investigating a nuclear incident or in minimizing its effects.

Each such payment made by the companies shall reduce by the amount of such payment the limit of the companies' liability under this policy.

If, during the policy period or subsequent thereto, the total of such payments made by the companies shall exhaust the limit of the companies liability under this policy, all liability and obligations of the companies under this policy shall thereupon terminate and shall be conclusively presumed to have been discharged. This policy, if not theretofore canceled, shall thereupon automatically terminate.

Regardless of the number of years this policy shall continue in force and the number of premiums which shall be payable or paid, the limit of the companies' liability stated in the declarations shall not be cumulative from year to year.

4. Limitation of liability: Common occurrence

Any occurrence or series of occurrences resulting in bodily injury or property damage arising out of the radioactive, toxic, explosive or other hazardous properties of source material, special nuclear material or byproduct material—

(*a*) in the course of transportation from the facility or to the facility from a nuclear facility owned by the United States of America and also arising out of such properties of other such material in the course of transportation from one or more other nuclear facilities or to one or more such facilities from one or more nuclear facilities owned by the United States of America, or

(*b*) discharged or dispersed from the facility over a period of days, weeks, months, or longer and also arising out of such properties of other such material so discharged or dispersed from one or more other nuclear facilities,

shall be deemed to be one nuclear incident.

With respect to such bodily injury and property damage (1) the total aggregate liability of the companies under all nuclear energy liability policies (facility form), including this policy, applicable to such incident shall be the sum of the limits of liability of all such policies, the limit of liability of each such policy being as determined by condition 3 thereof, but in no event shall such total aggregate liability of the companies exceed _____;[2] (2) the total liability of the companies under this policy shall not exceed that proportion of the total aggregate liability

[2] Policies issued by the Nuclear Energy Liability Insurance Association would specify $46.5 million; policies issued by the Mutual Atomic Energy Liability Underwriters would specify $13.5 million.

of the companies, as stated in clause (1) above, which (*a*) the limit of liability of this policy, as determined by condition 3, bears to (*b*) the sum of the limits of liability of all such policies issued by the companies, the limit of liability of each such policy being as determined by condition 3 thereof.

The provisions of this condition shall not operate to increase the limit of the companies' liability under this policy.

5. Notice of occurrence, claim or suit

In the event of bodily injury or property damage to which this policy applies or of an occurrence which may give rise to claims therefor, written notice containing particulars sufficient to identify the insured and also reasonably obtainable information with respect to the time, place, and circumstances thereof, and the names and addresses of the injured and of available witnesses, shall be given by or for the insured to _____ or the companies as soon as practicable. If claim is made or suit is brought against the insured, he shall immediately forward to _____ or the companies every demand, notice, summons, or other process received by him or his representative.

6. Assistance and cooperation of the insured

The insured shall cooperate with the companies and, upon the companies' request, attend hearings and trials and assist in making settlements, securing and giving evidence, obtaining the attendance of witnesses and in the conduct of any legal proceedings in connection with the subject matter of this insurance. The insured shall not, except at his own cost, make any payment, assume any obligation or incur any expense.

7. Action against companies—Coverages A and C

No action shall lie against the companies or any of them unless, as a condition precedent thereto, the insured shall have fully complied with all the terms of this policy, nor until the amount of the insured's obligation to pay shall have been finally determined either by judgment against the insured after actual trial or by written agreement of the insured, the claimant, and the companies.

Any person or organization or the legal representative thereof who has secured such judgment or written agreement shall thereafter be entitled to recover under this policy to the extent of the insurance afforded by this policy. No person or organization shall have any right under this policy to join the companies or any of them as parties to any action against the insured to determine the insured's liability, nor shall the companies or any of them be impleaded by the insured or his legal representative. Bankruptcy or insolvency of the insured or of the insured's estate shall not relieve the companies of any of their obligations hereunder.

8. Action against companies—Coverage B

No suit or action on this policy for the recovery of any claim shall be sustainable in any court of law or equity unless all the requirements of this policy shall have been complied with and unless commenced within 2 years after the nuclear incident which results in the property damage.

9. Insured's duties when loss occurs—Coverage B

In the event of property damage resulting from a nuclear incident, the insured shall furnish a complete inventory of the property damage claimed, showing in detail the amount thereof. Within 91 days after such incident, unless such time is extended in writing by the companies, the insured shall render to the companies a proof of loss, signed and sworn to by the insured, stating the knowledge and belief of the insured as to the following: Identification of the nuclear incident; the interest of the insured in the property destroyed or damaged, and the amount of each item of property damage claimed; all encumbrances on such property; and all other contracts of insurance, whether valid or not, covering any of such property. The insured shall include in the proof of loss a copy of all descriptions and schedules in all policies. Upon the companies' request, the insured shall furnish verified plans and specifications of any such property. The insured, as often as may be reasonably required, shall exhibit to any person designated by the companies any of such property, and submit to examinations under oath by any person named by the companies and subscribe the same; and, as often as may be reasonably required, shall produce for examination all books of account, records, bills, invoices and other vouchers, or certified copies thereof if originals be lost, at such reasonable time and place as may be designated by the companies or their representatives, and shall permit extracts and copies thereof to be made.

10. Appraisal—Coverage B

In case the insured and the companies shall fail to agree as to the amount of property damage, then, on the written demand of either, each shall select a competent and disinterested appraiser and notify the other of the appraiser selected within 20 days of such demand. The appraisers shall first select a competent and distinterested umpire and, failing for 15 days to agree upon such umpire, then, on request of the insured or the companies, such umpire shall be selected by a judge of a court of record in the State in which the property is located. The appraisers shall then appraise each item of property damage and, failing to agree, shall submit their differences only to the umpire. An award in writing, so itemized, of any two when filed with the companies shall determine the amount of property damage. Each appraiser shall be paid by the party selecting him and the expenses of the appraisal and umpire shall be paid by the parties equally. The companies shall not be held to have waived any of their rights by any act relating to appraisal.

11. Subrogation

In the event of any payment under this policy, the companies shall be subrogated to all the insured's rights of recovery therefor against any person or organization, and the insured shall execute and deliver instruments and papers and do whatever else is necessary to secure such rights. Prior to knowledge of a nuclear incident the insured may waive in writing any right of recovery against any person or organization, but after such knowledge the insured shall not waive or otherwise prejudice any such right of recovery.

The companies hereby waive any rights of subrogation acquired against the United States of America or any of its agencies by reason of any payment under this policy.

The companies do not relinquish, by the foregoing provisions, any right to restitution from the insured out of any recoveries made by the insured on account of a loss covered by this policy of any amounts to which the companies would be entitled had such provisions, or any of them, not been included in this policy.

12. Other insurance

If the insurance afforded by this policy for loss or expense is concurrent with insurance afforded for such loss or expense by a nuclear energy liability policy (facility form) issued to the name insured by the [3]_____, hereinafter called "concurrent insurance," the companies shall not be liable under this policy for a greater proportion of such loss or expense than the limit of liability stated in the declarations of this policy bears to the sum of such limit and the limit of liability stated in the declarations of such concurrent policy.

If the insured has other valid and collectible insurance (other than such concurrent insurance or any other nuclear energy liability insurance issued by the companies or the [3]_____, to any person or organization) applicable to loss or expense covered by this policy, the insurance afforded by this policy shall be excess insurance over such other insurance; provided, with respect to any person who is not employed at and in connection with the facility, such insurance as is afforded by this policy for bodily injury to an employee of the insured arising out of and in the course of his employment shall be primary insurance under such other insurance.

13. Changes

Notice to any agent or knowledge possessed by any agent or any other person shall not effect a waiver or a change in any part of this policy or estop the companies from asserting any right under the terms of this policy; nor shall the terms of this policy be waived or changed, except by endorsement issued to form a part of this policy executed by the [3]_____ on behalf of the companies.

14. Assignment

Assignment of interest by the named insured shall not bind the companies until their consent is endorsed hereon; if, however, the named insured shall die or be declared bankrupt or insolvent, this policy shall cover such insured's legal representative, receiver or trustee as an insured under this policy, but only with respect to his liability as such, and then only provided written notice of his appointment as legal representative, receiver or trustee is given to the companies within 10 days after such appointment.

[3] Mutual Atomic Energy Liability Underwriters or Nuclear Energy Liability Insurance Association, as appropriate.

15. Cancellation

This policy may be canceled by the named insured by mailing to the companies and the U.S. Atomic Energy Commission written notice stating when, not less than 30 days thereafter, such cancellation shall be effective. This policy may be canceled by the companies by mailing to the named insured at the address shown in this policy and to the U.S. Atomic Energy Commission written notice stating when, not less than 90 days thereafter, such cancellation shall be effective; provided in the event of nonpayment of premium or if the operator of the facility, as designated in the declarations, is replaced by another person or organization, this policy may be canceled by the companies by mailing to the named insured at the address shown in this policy and to the U.S. Atomic Energy Commission written notice stating when, not less than 30 days thereafter, such cancellation shall be effective. The mailing of notice as aforesaid shall be sufficient proof of notice. The effective date and hour of cancellation stated in the notice shall become the end of the policy period. Delivery of such written notice either by the named insured or by the companies shall be equivalent to mailing.

Upon termination or cancellation of this policy, other than as of the end of December 31 in any year, the earned premium for the period this policy has been in force since the preceding December 31 shall be computed in accordance with the following provisions:

(*a*) if this policy is terminated, pursuant to condition 3, by reason of the exhaustion of the limit of the companies' liability, all premium theretofore paid or payable shall be fully earned;

(*b*) if the named insured cancels, the earned premium for such period shall be computed in accordance with the customary annual short rate table and procedure, provided if the named insured cancels after knowledge of a nuclear incident, all premium theretofore paid or payable shall be fully earned;

(*c*) if the companies cancel, the earned premium for such period shall be computed pro rata.

Premium adjustment, if any, may be made either at the time cancellation is effected or as soon as practicable after cancellation becomes effective, but payment or tender of unearned premium is not a condition of cancellation.

16. Company representation

(*a*) Any notice, sworn statement or proof of loss which may be required by the provisions of this policy may be given to any one of the companies, and such notice, statement or proof of loss so given shall be valid and binding as to all companies.

(*b*) In any action or suit against the companies, service of process may be made on any one of them, and such service shall be deemed valid and binding service on all companies.

(*c*) ----------[4] is the agent of the companies with respect to all matters pertaining to this insurance. All notices or other communications required by this policy to be given to the companies may be given to such agent, at its office at----------with the same force and effect as if given directly to the companies. Any requests, demands or agreements made by such agent shall be deemed to have been made directly by the companies.

17. Authorization of named insured

The named insured is authorized to act on behalf of all insureds with respect to giving and receiving of notice of cancellation of this policy, the payment of premiums, and receiving of return premiums.

18. Declarations

By acceptance of this policy the named insured agrees that the statements in the declarations are the agreements and representations of the named insured, that this policy is issued in reliance upon the truth of such representations, and that this policy embodies all agreements between the named insured and the companies, or any of their agents, relating to this insurance.

In witness whereof,

(Execution clause to be inserted.)

For subscribing companies
By ----------

[4] Mutual Atomic Energy Liability Underwriters or Nuclear Energy Liability Insurance Association, as appropriate.

Nuclear energy liability policy (facility form).
February 1, 1957 (second revision).

Nuclear energy liability policy No. ------
(Facility form)

DECLARATIONS

Item 1. Named insured ----------
Address ----------
(No. Street Town or City State)

Item 2. Policy period: Beginning at 12:01 a.m. on the ---- day of ----------, 19----, and continuing through the effective date of cancellation or termination of this policy, standard time at the address of the named insured as stated herein.

Item 3. Description of the facility:
Location ----------

Type ----------

The operator of the facility is ----------

Item 4. The limit of the companies' liability is $---------- subject to all the terms of this policy having reference thereto.

Item 5. Advance premium $----------.

Item 6. These declarations and the schedules forming a part hereof give a complete description of the facility, insofar as it relates to the nuclear energy hazard, except as noted ----------
---

Countersigned ----------, 19----, at ----------
By ----------
Authorized representative

Nuclear energy liability policy (facility form)—Declarations.
February 1, 1957 (second revision).

Appendix B

Statement of Insurance Syndicates [1]

As you know the Nuclear Energy Liability Policy (facility form) is a continuous contract which remains in effect until terminated by exhaustion of its aggregate limit of liability or until cancellation by either party. Insuring agreement IV limits the application of the policy to bodily injury or property damage caused during the policy period and for which claim is made not later than 2 years after the end of the policy period.

Question has been raised by the Commission and insurance buyers concerning this 2-year discovery period. The buyers' concern is primarily motivated by the fear that insurers might arbitrarily exercise their right to cancel a policy. Since the discovery period has no application while the policy remains in force, there are only two other situations where it would come into effect. If a policy were terminated because of the exhaustion of its aggregate limit of liability, the discovery clause would apply, but since in such a situation there is no longer any money available for the payment of claims no problems can arise from the running of the 2-year period.

The second situation would arise where the insured elects to cancel a contract. It would appear that if the insured elects to cancel he is not unduly concerned with present or future losses and the 2-year discovery period is more than adequate. It should be noted that both NELIA and MAELU have made arrangements to permit a facility operator who so desires to keep his policy in effect for as long after the facility is shut down as seems prudent. Similar arrangements can be made by the purchaser of a facility, a receiver or trustee in bankruptcy.

Insurance buyers who are fearful that the pools will arbitrarily cancel policies and thereby invoke the 2-year discovery period have ignored the realities of the situation. It would have been impossible to assemble liability insurance capacity if the obligations could not be terminated within a reasonable time if intolerable

[1] Excerpt from letter dated Jan. 23, 1959, from Nuclear Energy Liability Insurance Association and Mutual Atomic Energy Liability Underwriters to H. L. Price, Director, Division of Licensing and Regulation, U.S. Atomic Energy Commission.

conditions arose. A large loss, while unpleasant to contemplate, is not of itself intolerable. The nuclear industry has already established a remarkable safety record, but small and large losses are possible, and that is what insurance is for. If, however, emergence of losses should produce evidence of breakdown in the safe handling and use of nuclear materials by certain licensees, continued coverage of the offending risks could become intolerable. While undoubtedly the Commission can be expected to move quickly to protect the public in such a situation, the insurers would be less than prudent if they did not reserve some right to protect themselves. Indeed, it is the statutory duty of every insurer to protect its assets for the benefit of its policyholders and claimants.

Furthermore, since the fundamental purpose behind the formation of the nuclear liability insurance pools is to obviate the need for Government intervention in the field of private insurance wherever possible, any assumption that the insurers would cancel arbitrarily in any situation, and particularly in the hope of escaping the consequences of a large incident, is unrealistic. From the beginning the insurance industry has maintained that it is the best qualified agency to adjust and pay the great majority of losses that are likely to result from the licensee program. In consequence, it would always object to the intervention of the Government where private enterprise can perform. Arbitrary cancellations by the pools would constitute an invitation to the Government to intervene in this area—an invitation which the insurance companies will not willingly extend.

The very presence of a suspension condition in the policy, which condition does not invoke the discovery period, is further evidence of intent to use cancellation only as a last resort. If it had been planned to cancel lightly the insurers could have protected themselves better and simplified the policy by shortening the period of notice of cancellation and deleting the suspension condition.

It is worth noting that with respect to most losses likely to arise, the NELIA-MAELU contract is much more liberal than that proposed for Great Britain and the OEEC and Euratom drafts. These drafts contain absolute 10-year limitations which means that under any circumstances the insurers are relieved of liability 10 years after an incident. Such protection is much less complete than that offered by a NELIA-MAELU contract that is kept in force, since the discovery period never starts to run.

Finally, it should be pointed out that the first nuclear liability insurance binders were issued in March 1957 so that there has been nearly 2 years of actual experience with the cancellation clause. During that time two buyers have canceled their insurance. Others have reduced policy limits, which amounts to partial cancellation. No binder has been canceled by either pool.

APPENDIX C

REPORTS TO THE COMMISSION BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS CONCERNING REACTOR PROJECTS SUBJECT TO LICENSING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., January 15, 1959.

Subject: Carolinas Virginia nuclear powerplant, Parr, S.C.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 12th meeting in Washington, December 11–13, 1958, the Advisory Committee on Reactor Safeguards reviewed the characteristics of the site proposed for this reactor. The Committee considered this reactor site again at its 13th meeting on January 8–10, 1959. Data concerning the site were presented in the reports referenced below and discussed orally by the Hazards Evaluation Branch.

The project is for the investigation and development of a pressure tube type reactor of 60.5 megawatts (heat) capacity. Heavy water will be used as an unpressurized moderator while the light water coolant is pressurized. Containment is contemplated. The reactor will be connected with an existing steamplant.

The proposed site is located adjacent to a company-owned village of Parr, S.C., with a population of 58.

It is concluded that a reactor of this general type and power level as presently proposed including provision of suitable containment could be operated at this

site without undue hazard to the health and safety of the public. The advisability of abandoning the village of Parr should be decided prior to the beginning of operation.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

Proposal for a power demonstration reactor by Carolinas Virginia Nuclear Power Associates, Inc., August 1958.

Hazards Evaluation Report to the Advisory Committee on Reactor Safeguards, December 2, 1958.

U.S. Weather Bureau Comments on Preliminary Site Evaluation, Nuclear Powerplant, Parr, S.C., December 8, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., January 12, 1959.

Subject: Consolidated Edison reactor.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 12th meeting, December 11–13, 1958, the Advisory Committee on Reactor Safeguards reviewed the containment proposed for the nuclear power station being built for the Consolidated Edison Co., at Indian Point, N.Y. Members of the Hazards Evaluation Branch and representatives of the Consolidated Edison Co., Babcock & Wilcox Co., and the Vitro Corp. of America participated in the discussion. Documents pertinent to this proposal are referenced below. The Committee considered this proposal further at its 13th meeting, January 8–10, 1959.

The proposed steel sphere and the heavy-walled concrete building enclosing it will provide the most nearly complete containment presented to the Committee in any reactor project to date. The Committee is satisfied that this containment will provide protection to the public. This favorable opinion relates to the proposed containment structures only. Information regarding the safety of the reactor itself and its operation will be considered later.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

(1) Evaluation of Potential Radiation Hazard Resulting from Assumed Release of Radioactive Wastes to Atmosphere from the Proposed Buchanan Nuclear Powerplant, April 1957.

(2) Core Design and Characteristics for the Consolidated Edison Reactor, August 18, 1958.

(3) Report on Hazards Analysis and Design for Containment Vessel for the Consolidated Edison Reactor, August 29, 1958.

(4) Division of Licensing and Regulation Report to the Advisory Committee on Reactor Safeguards on Consolidated Edison Co. of New York Indian Point Reactor, December 3, 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., November 12, 1958.

Subject: Westinghouse Testing Reactor (WTR)

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: During its 11th meeting, November 7, 1958, the Advisory Committee on Reactor Safeguards reviewed the Westinghouse testing reactor. The WTR is a water-moderated and cooled heterogeneous reactor located at Waltz Mills, Pa., and nearing completion under a construction permit issued by the Commission. The Westinghouse Co. is now requesting a license to operate this reactor at a power of 20 megawatts. For its review, the ACRS was furnished Westinghouse report, WCAP–369 (revised), and discussed the reactor with the Division of Licensing and Regulation and with Westinghouse personnel.

In many respects the WTR is similar to the materials testing reactor for which 8 years of operating experience is available. Thus both the characteristics of this type of reactor and the operating problems associated with its testing function are well known. Like the MTR, the WTR will also be operated in conjunction with a critical facility with which the reactivity of new experiments can be determined with fair precision. In addition, the WTR is housed in a large steel vessel designed to contain, with nominal leakage, the fission products which might be released in a severe reactor accident.

The Advisory Committee on Reactor Safeguards concludes that the Westinghouse testing reactor can be operated without undue hazards to the health and safety of the public.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

WCAP–369 (revised).
Amendment No. 8 to license application, September 29, 1958.
Amendment No. 9 to license application, October 30, 1958.
HEB Staff Analysis, October 7, 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., November 4, 1957.

Subject: Dresden Nuclear Power Station—Enclosure.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: This letter constitutes an interim report of the Advisory Committee on Reactor Safeguards on the reactor for which construction permit No. CPPR–2 has been issued to the Commonwealth Edison Co.

The Committee reviewed the design characteristics of the containment vessel being constructed for this reactor.

It is the opinion of the Committee that the proposed containment vessel for the Dresden Nuclear Power Station will contain the maximum credible accident postulated by the applicant. On the basis of the information reviewed to date by the Committee, it seems reasonable that this postulated accident is the most serious which might occur.

This opinion is based upon the technical information regarding the containment vessel made available to the Committee covering (*a*) design specifications, (*b*) construction methods, (*c*) methods of testing, and (*d*) general procedures for the proper arrangements for reinspection and interim testing, the details of which will be supplied before operation.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., October 21, 1958.

Subject: Commonwealth Edison Co.—Dresden Nuclear Power Station.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 10th meeting on October 16, 1958, the Advisory Committee on Reactor Safeguards reviewed the application of the Commonwealth Edison Co. for an operating license for its Dresden nuclear power station. The general design and containment of this reactor were discussed with representatives of the company and members of the Hazards Evaluation Branch. The review of the plan of operation and any proposed emergency procedures was deferred.

The Committee does not see any problems of concern relating to the possible hazards of this nuclear powerplant, but the Committee has not had time to complete its consideration of this reactor. It will give a more detailed report at a later date.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

(1) GEAP–1044—Preliminary Hazards Summary Report for the Dresden Nuclear Power Station, September 3, 1957.

(2) Amendment No. 1 to Preliminary Hazards Summary Report for the Dresden Nuclear Power Station, May 26, 1958.

(3) Amendment No. 2 to Preliminary Hazards Summary Report for the Dresden Nuclear Power Station, August 25, 1958.

(4) Report to ACRS by Division of Licensing and Regulation, October 3, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., October 21, 1958.

Subject: Yankee Atomic Electric Co.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 10th meeting on October 15, 1958, the Advisory Committee on Reactor Safeguards reviewed amendments No. 7 and No. 8 to the application of the Yankee Atomic Electric Co. for a license to operate the nuclear powerplant the company is constructing at Rowe, Mass. The Committee had available to it the material referenced on the last page.

Amendment No. 7 proposed an alternative to the measures recommended by the Committee in its letter of September 16, 1957, for determining the effects of plutonium buildup on the nuclear characteristics and stability of this reactor. Amendment No. 8 described the waste disposal facilities planned for the Rowe plant.

Amendment No. 7

In Amendment No. 7, Yankee states that determination of the effect of plutonium buildup by measurements on synthetic fuel elements made up of uranium and plutonium in a part-core critical facility, as suggested in the Committee's earlier letter, would be difficult to interpret because of the impossibility of duplicating the temperatures and neutron spectrum of the actual Yankee reactor in this facility. As an alternative and more dependable procedure for determining the effect of plutonium, Yankee proposes an experimental program to measure temperature coefficients, prompt and overall, in the actual power reactor at startup, after 2,000 hours of operation, and at intervals while plutonium is growing into the core.

To establish that the reactor can be operated safely while plutonium is building up in the core during the interval between experimental measurements, Yankee described calculations made by Westinghouse and by Nuclear Development Corp. of America which show that the buildup of plutonium during even the entire anticipated fuel lifetime of 10,000 hours will have only a minor effect on the overall temperature coefficient of reactivity.

The Committee concurs with Yankee's proposal to determine these temperature coefficients in the actual reactor rather than in the part-core critical facility and agrees with Yankee's judgment that the effect of plutonium buildup on these coefficients will be small enough to permit these measurements to be made with safety in the actual reactor. In this, the Committee concurs with the determination of the Hazards Evaluation Branch.

The Committee recommends that Yankee be asked to provide a description of the specific experiments which will be made to determine the effects of plutonium buildup on prompt and overall temperature coefficients. It suggests that controlled transient experiments, with known sinusoidal or step changes in reactivity, may be a convenient means of measuring these coefficients.

Amendment No. 8

The Committee heard a detailed description of the facilities planned by Yankee for disposal of gaseous, liquid and combustible solid wastes. It believes that the design of these facilities is conservative and concurs with the conclusion of the Hazard Evaluation Branch that the proposed facilities will permit the disposal of wastes without undue hazard to onsite or offsite personnel.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References

(1) Amendment No. 3 to "Preliminary Hazards Summary Report" by Yankee Atomic Electric Co., dated April 1957.

(2) Amendment No. 4 to "Preliminary Hazards Summary Report" by Yankee Atomic Electric Co., dated July 15, 1957.

(3) Amendment No. 6 to "Preliminary Hazards Summary Report" by Yankee Atomic Electric Co., dated March 5, 1958.

(4) Amendment No. 7 to "Preliminary Hazards Summary Report" by Yankee Atomic Electric Co., dated July 21, 1958.

(5) Amendment No. 8 to "Preliminary Hazards Summary Report" by Yankee Atomic Electric Co., dated July 28, 1958.

(6) Report to ACRS by Division of Licensing and Regulation, dated September 29, 1958.

(7) Memorandum from R. C. Dalzell to H. L. Price, subject: "Yankee Atomic Electric Co. License Application Amendments No. 7 and No. 8," dated September 2, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., October 21, 1958.

Subject: Yankee Atomic Electric Co.

Mr. HAROLD L. PRICE,
Director, Division of Licensing and Regulation, U.S. Atomic Energy Commission, Washington, D.C.

DEAR MR. PRICE: The Committee finds that there are some matters relating to the Yankee reactor on which it should have more information before it can give its final opinion on the overall safety of this reactor. These are:

(1) The means that will be used to estimate the distribution of neutron flux and heat flux in the reactor so that the margin of operation below burnout conditions can be determined.

(2) The results of experiments on the extent of precipitation of solids from water containing the amounts of boric acid and lithium hydroxide expected in the operating reactor, under the conditions of temperature, pressure, and radiation intensity which will be experienced in the reactor.

(3) The principles and procedures to be used in operating this reactor.

Would you please arrange to have this information developed for us?

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 8, 1958.

Subject: General Electric boiling water reactor at Vallecitos.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The problems of the Vallecitos boiling water reactor were considered by the Advisory Committee on Reactor Safeguards with representatives of the licensee, General Electric Co., and the Hazards Evaluation Branch. The pertinent documents are listed below.

General Electric has asked for three revisions to their license, construction permit CPPR–3 and license Nos. CX–2 and DPR–1 as amended, for this reactor. Amendment No. 14 would increase the number of rod-type elements in a loading, from 1 to 14 for thermal powers up to 20 megawatts. Amendment No. 15 would increase allowable thermal power with mixed flat plate and 14 rod-type elements, from 20 to 30 megawatts. Amendment No. 16 would allow heating of the reactor from cold to operating temperature by nuclear heat at a rate not exceeding 1 megawatt instead of by heat supplied to the coolant externally.

In view of the reported performance so far obtained in operations of this reactor, the Committee sees no significant increase in hazard in following these proposals provided that rod-type elements be so dispersed in the core as to be as uniformly surrounded by plate type elements as possible.

There seems to be some possibility of a "cold-water" type accident in operation of the system and its controls as now constituted, i. e., sudden introduction of

cold coolant into reactor causing excessive increase in activity and power. This possibility should receive further study and if modifications of control systems or operating procedures are necessary to ensure against such an accident they should be made before resuming operation.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

References:

(1) GE–BWR Report SG–VAL 1.
(2) GE–BWR Report SG–VAL 2.
(3) Amendments Nos. 13 through 16.
(4) HEB Staff Report of February 25, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., August 5, 1958.

Subject: General Electric Vallecitos boiling water reactor (GE–VBWR).

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: The Advisory Committee on Reactor Safeguards at its ninth meeting on August 4, 1958, considered amendment No. 24 to the license application of the General Electric Co. for the operation of the Vallecitos boiling water reactor. This amendment is designed to provide the operator with greater latitude in the choice of fuel elements and operating limits. In reviewing the amendment application the Committee considered the supporting material submitted in the reports referenced below and held a meeting with representatives of the applicant and members of the Hazards Evaluation Branch.

The Committee believes that the technical specifications set out in section 1 of amendment No. 24 define a scope of operations within which it is possible to operate without undue hazard to the public. This belief is based on the assumption that the specifications outlined do not affect the magnitude of the postulated maximum credible accident, which the applicant has shown does not result in the release of dangerous amounts of radioactivity beyond the site boundary provided the container maintains its specified leak tightness. While, as stated, it is the Committee's belief that the proposed technical limitations have no influence on the magnitude of the maximum credible accident, this has not in fact been clearly demonstrated by the applicant, and we believe this point should be documented more definitely.

On the other hand, the Committee would like to emphasize that the technical specifications alone do not guarantee the safe operation of the reactor, especially from the standpoint of hazards within the boundaries of the site.

The Committee is concerned with the mounting number of amendments to the licensee's application on the VBWR operation which apparently stems from attempts to cover a multiplicity of specific situations pertinent to the safe operation of the reactor. Rather than improving the safety it seems possible that the real issues of safe operation may get beclouded by changing one set of circumstances for another.

The Advisory Committee on Reactor Safeguards suggests that the applicant be permitted within the scope of amendment No. 24 to assume technical responsibility concerning hazards in connection with his experimental program.

The latitude contemplated in the proposed amendment imposes a special responsibility on the applicant to review each proposed change in operating conditions in the light of its effect on the probability of an accident and on the possible severity of the accident if it occurs.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

(1) Amendment No. 24 to License Application for Vallecitos Boiling Water Reactor, May 14, 1958.
(2) SG–VAL–2, Second Edition, Final Hazards Summary Report, May 8, 1958.
(3) Key to Second Edition of SG–VAL–2, May 8, 1958.
(4) Report to ACRS by Division of Licensing and Regulation on GE–VBWR, August 1, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., July 12, 1958.

Subject: General Electric test reactor (GETR).

Dr. WILLARD F. LIBBY,
Acting Chairman, U.S. Atomic Energy Commission, Washington, D.C.

DEAR DR. LIBBY: The Advisory Committee on Reactor Safeguards reviewed at its eighth meeting, July 10–12, 1958, the proposal of the General Electric Co. to operate the General Electric test reactor. The Committee had previously offered advice on this reactor at its second meeting, November 1–3, 1957, in connection with the General Electric request for a construction permit. In its current review, the Committee had access to the reports referenced below and discussed the proposal with representatives from both the General Electric Co. and the Hazards Evaluation Branch.

The GETR is a pressurized water reactor operating at 33 megawatts (thermal) located at the General Electric Vallecitos Atomic Laboratory, Pleasanton, Calif. A large body of information and experience exists on the nuclear, hydraulic, and mechanical behavior of the components of pressurized water reactor systems. The primary area of uncertainty, with regard to reactor safety, now concerns the transient response of this type of reactor to rapid additions of excess reactivity. Pertinent information is now being obtained as part of the SPERT program. However, in this interim period, considerable guidance as to reactor dynamics can be obtained from existing Borax and SPERT data. The ACRS believes that operation of this reactor, considered separately from the intended experimental program, presents no greater hazard than many other reactors now approved for operation.

A judgment as to the continuous safe operation of this reactor including its testing function presents an additional problem because of the inability to define precisely the specific characteristics of the future experimental program. Relatively more dependence must be placed upon the sound judgment of the operators of test reactors than upon that of operators of reactors for which less flexibility is required. While it is hoped that in the future more flexible definitions of the areas for the independent action on the part of operators for testing reactors will be developed, the ACRS believes that the General Electric Co. has proposed reasonably acceptable limitations within which the GETR staff may take action independent of prior AEC approval.

The Advisory Committee on Reactor Safeguards thus advises that the GETR may be operated as a testing reactor as proposed by the General Electric Co. without undue hazard to the public.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

Amendment No. 3 to License Application for GETR, February 26, 1958.
Amendment No. 4 to License Application for GETR for Experimental Facilities May 15, 1958.
Amendment No. 5 to License Application for GETR. June 18. 1958.
HEB Staff Report on GETR, June 27, 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., January 13, 1958.

Subject: The MIT reactor, docket No. 50–20.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The Massachusetts Institute of Technology has applied for license to operate its nuclear reactor located in Cambridge, Mass., construction of which is now nearing completion. This letter is in rely to a request by the Atomic Energy Commission for the advice of the Advisory Committee on Reactor Safeguards with respect to the safety of the proposed operation of this reactor.

The Committee's advice is based upon information contained in the application and amendments thereto. The former Advisory Committee on Reactor Safeguards reviewed the proposed design of the reactor prior to the issuance of a construction permit and submitted a report, dated March 5, 1956, on this matter to the General Manager.

This is a research reactor designed for 1 megawatt (thermal) utilizing enriched alloy plate-type fuel elements and D_2O cooling and moderation. It incorporates many of the design principles of the CP–5 and MTR reactors. There are no novel features requiring demonstration and no important changes in design have been made since the review for a construction permit.

The reactor is located in a densely populated area close to public activities. Therefore, it is essential that effective administrative controls and effective operating and emergency procedures be established and maintained. The applicant has indicated provision for such controls and procedures, which appears to the Committee to be adequate.

While the Committee believes that any serious release of fission products is highly improbable, it is important that containment be maintained because of the location of the facility. The containment proposed is generally adequate. However, there is one point of weakness, namely, complete dependence on the reliability of the automatic valve closure mechanism in the ventilation system. The Committee recommends that provision be made for some effective auxiliary means of closing the inlet and outlet lines of the ventilation system. Such a requirement could be met by provision for manual operation of the present valves in addition to the automatic operation already installed or by some other effective means. However, such a requirement is not considered necessary prior to the commencement of the research program.

In the opinion of this Committee, this reactor can be operated with an acceptable degree of risk to the health and safety of the public.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

NOVEMBER 5, 1957.

Subject: National Advisory Committee for Aeronautics (NACA)—Docket No. 50–30.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: This letter constitutes the report of the Advisory Committee on Reactor Safeguards on the application for a construction permit by the NACA, docket No. 50–30, in accordance with section 182 of the Atomic Energy Act of 1954, as amended.

The application is for a test reactor designed to operate at power levels up to 60 megawatts of heat. It is to be located 3 miles south of Sandusky, Ohio.

One purpose of the reactor is to test nuclear fuel bearing components to destruction or near destruction. This aspect of the experimental program leads the Committee to be especially concerned with the operation of this reactor at a site so close to a densely populated area.

The Committee is of the opinion that with the proposed container and at the selected site it is possible so to restrict the experimental program that the operation of the reactor will not result in appreciable hazard to the public. However, the necessary restrictions may add materially to the cost of the program and may impose serious time delays. Further, some experiments which fall within the general type of experimental program proposed by NACA may not be permissible at this location.

In view of the above, the Committee believes that the facility proposed would be more useful for the program proposed if it were located at a site less close to a center of population.

It is the opinion of the Committee that NACA is providing reasonable precautions to avoid the escape of radioactivity which is likely to be damaging to the health and safety of the public. Among these precautions are three important items:

(1) NACA proposes to place the reactor within a pressure vessel which has as its design criterion a maximum leakage rate of 115 cubic feet per day. Furthermore, the applicant has proposed a variety of measures to check the leak tightness of this container during operations. It is difficult to prove and maintain a leakage rate this low but if such a rate actually can be demonstrated and maintained the Committee believes that it should provide adequate protection to the health and safety of the public.

(2) NACA is proposing to enclose each test loop within a secondary tank or container which is designed to contain the possible releases of fission products and other radioactive materials in case of breakdown of the fuel elements and other components being tested. The committee believes that this would be a valuable additional safeguard but is not convinced that this secondary container can be depended upon under all circumstances.

(3) The proposed design includes means to prevent the release directly to the atmosphere of effluents from the operation of the reactor or from the experimental loops. Again, the Committee agrees that this is an important safeguard but does not believe that accidental release to the atmosphere can be entirely precluded.

The applicant proposes to establish a procedure for reviewing planned experiments in order to minimize the possibility of any failure which would release radioactivity even through the secondary enclosure.

The Committee believes that testing of fuel elements under conditions well within limits of possible failure does not offer a significant potential hazard provided that the experiments are properly designed and operated. However, testing of fuel elements in such a way that they are likely to be destroyed may not be permissible. Since NACA has not defined any specific experiments, the Committee is unable to state a more precise opinion than the above.

The Committee also believes that the operation of a test reactor at a site of this nature requires extensive area monitoring both on and off site so that any release of radioactivity to the environment may be detected as soon as possible and necessary protective or warning measures for the public carried out.

The Committee is aware of the risk that pressure may be brought to bear to permit a loosening of restrictions. This could come about as a result of a false sense of security which might develop from a period of successful operation and as a result of the importance of proposed experimental programs to the national defense. This problem would not be as serious if the proposed reactor were located at a less populated site.

The following are additional remarks by Dr. Abel Wolman:

"While I agree with all that the Committee has stated, I feel that I must add some remarks for purposes of clarifying my own position. In view of the prospect of future continuing debates as to the safety of conducting essential experiments at this site, I would recommend against the site on the information presently available. I believe that the applicant should be required to consider the availability of other sites at which operation of the reactor would be feasible and which would afford a higher degree of protection to the health and safety of the public.

"It is unrealistic to permit operation at this site if experiments of importance to the national defense are likely to have to be curtailed because of the site. The realities of human behavior are such that operation of experiments, the hazards of which may be uncertain, are likely to be permitted if they are important to the national defense.

"I do not believe that we should freeze on a site in a situation like this merely because an applicant has chosen it."

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

APPENDIX D

REPORTS TO THE COMMISSION BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS CONCERNING COMMISSION REACTOR PROJECTS

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 16, 1959.

Subject: Nuclear merchant ship reactor project (NS *Savannah*).

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission, Washington 25, D.C.

DEAR MR. MCCONE: At its 14th meeting (March 12–14, 1959) the Advisory Committee on Reactor Safeguards continued its review of the nuclear merchant ship (NS *Savannah*). Representatives were present from the Division of Reactor Development, Babcock & Wilcox Co., New York Shipbuilding Corp., Geo. G.

Sharpe Co., States Marine Corp., and the U.S. Coast Guard. The ACRS has also had the benefits of thorough review of the ship by the Hazards Evaluation Branch and by Oak Ridge personnel. The pertinent documents are listed at the end of this letter.

Inasmuch as a final hazards review for the NS *Savannah* has not yet been submitted, and considerable information is still outstanding, the ACRS is not in a position to make a final recommendation to the Commission concerning the overall safety of this nuclear ship and the possible restrictions which may be required for the adequate protection of the public. However, the committee has been asked to make an interim report. The ACRS has focused its attention primarily upon the nuclear propulsion system for which a large part of the information is available.

Pressurizer.—In the NS *Savannah*, the pressurizer not only maintains the primary system pressure, but also provides a heat source and sink for reducing pressure transients which occur during changes in load demand. The ACRS believes that the pressurizer can be made to work without jeopardizing the safety of the ship. The ACRS is somewhat uncertain as to the adequacy of the detailed design of the pressurizer inasmuch as the detailed information of transient response of the pressurizer has not been submitted to us. Under any circumstances, the actual performance of the system in addition to analog simulation, must be available before complete confidence in the adequacy of the system can be assured.

Rod control and scram system.—The design of this combined electrical rod drive and hydraulic scram system is new. The adequacy of this system should be demonstrated by extensive testing of prototypes and selected production units under all credible conditions of life, presence of solids in the water, misalignment, angle of roll and tilt, etc.

Containment.—The design of the containment vessel seems adequate provided the numerous penetrations do not themselves provide a channel through which fission products escape. The ACRS does not yet have sufficient information to decide whether the valving on these penetrations is adequate.

Interlocks on loop pumps.—A cold water accident initiated by the starting of an idle, cold-loop pump might create a serious nuclear excursion even if the scrams work. Therefore, it is essential that reliable and multiple interlocks be used to prevent this possible accident.

Miscellaneous comments.—The considerations of the shock loading under collisions appear to be adequate. However, ACRS has not fully completed its review in this area.

In view of the new design and unproven features associated with the reactor used in the NS *Savannah*, the Committee is of the opinion that the extensive shakedown and testing required should not be carried out over the full power range at the dockside location. The Committee advises that severe limits must be placed on the operations during the dockside testing and understands that the necessity for restrictions has been recognized.

The meteorological problems at this site (and also in general for rivers, estuaries, ports and at sea) have not been adequately resolved.

The required maneuverability of the ship results in a large amount of thermal cycling of the UO_2 fuel elements. This places an increased burden on the testing required to prove adequacy of fuel elements. It is obvious that a steam bypass around the turbine would reduce the problems associated with the thermal cycling.

The Committee is also not yet convinced that the operator will have a sufficiently informed staff to execute its overall responsibility for the safety of the nuclear ship. It is aware that crew members are in training. However, it urges that States Marine Corporation quickly acquire individuals who can understand and partake in the hazards analyses which are now underway.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

(1) Preliminary Safeguards Report—Babcock & Wilcox Co., BAW–1117: Volume I, revised December 22, 1958. Volume II, revised November 3, 1958.

(2) DLR Comments to ACRS on Nuclear Merchant Ship Reactor Project (NS *Savannah*), November 4, 1958.

(3) DLR Report to ACRS on NS *Savannah* Control System, January 5, 1959.

(4) DLR Report to ACRS on (NS *Savannah*) Nuclear Merchant Ship Reactor, February 24, 1959.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 16, 1959.

Subject: S1C—Submarine reactor.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 14th meeting, March 12–14, 1959, the Advisory Committee on Reactor Safeguards reviewed the S1C—Combustion engineering light water cooled reactor—which is a prototype submarine reactor installed within sections of a submarine hull modified to serve as a suitable containment vessel. This has been described in the listed documents. The installation is under construction at the combustion engineering project at Windsor, Conn. The reactor design deviates little from several other naval nuclear reactors reviewed previously and upon which operating experience is well known.

Based upon the data submitted, oral descriptions and discussions, the committee considers the S1C can be operated at this site without undue hazard to the health and safety of the public.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman.

References:
CEND–S1C–141, S1C Hazards Summary Report, February 6, 1959.
DLR Report to ACRS on the S1C Reactor, February 25, 1959.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., January 12, 1959.

Subject: Proposed nuclear power reactor for the city of Piqua, Ohio.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At the 12th meeting of the Advisory Committee on Reactor Safeguards on December 11–13, 1958, representatives of Atomics International, the city of Piqua, and the Division of Reactor Development described a revised plan for construction of an organic moderated nuclear powerplant in Piqua, Ohio. Earlier plans for this plant were reviewed by the Committee at its 10th and 11th meetings, and were the subject of letters to you dated August 5 and November 12, 1958. The revised plan presented at the 12th meeting is described in NAA–SR–MEMO 3405 entitled, "Supplement III to Preliminary Safeguards Report for the Piqua Organic Moderated Reactor (NAA–SR–3100)."

A subcommittee reviewed supplement III prior to the 13th ACRS meeting. At the 13th meeting, a report by the Hazards Evaluation Branch was reviewed, and oral discussion by representatives of the Division of Reactor Development indicated some changes in containment had been proposed.

The site now proposed appears more suitable than the location originally selected. However, the Committee does not consider the installation at this site of a nuclear powerplant of this capacity of a relatively untried type to be without undue public hazard until the present proposed unconventional type of containment is replaced by a more substantial and dependable system.

Chairman C. Rogers McCullough did not participate in these reviews and discussions.

Sincerely yours,

W. P. CONNER, Jr.,
Acting Chairman.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., November 12, 1958.

Subject: Proposed nuclear power reactor for the city of Piqua, Ohio.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 10th meeting on October 16, 1958, the Advisory Committee on Reactor Safeguards reviewed the organic moderated reactor proposed for installation at the Piqua municipal powerplant as a nuclear steam generator. Discussions of the proposal were held with the Division of Licensing and Regulation, representatives of the City of Piqua Municipal Power Commission and Atomics International. In addition, the Committee had available for reference purposes the preliminary safeguards report on the project, NAA–52–3100, and the report of the Hazards Evaluation Branch dated October 14, 1958.

Although the Committee is favorably impressed with the organic moderated reactor concept, and is aware of the generally favorable results of the OMRE experience to date, it wishes to reaffirm its opinion that the Piqua site proposed on October 16 for installation of a nuclear powerplant based on this concept is unsuitable. That site is in an urban area and makes no provision for an exclusion zone. Both the meteorological and the hydrological conditions are unfavorable to the safe dispersal of radioactive byproducts. The organic moderator presents a local fire hazard which is increased by the inclusion of a decay heat removal system employing a xylene boiler.

Representatives of Atomics International and the city of Piqua appeared before the Committee at its 11th meeting on November 6, 1958, with oral proposals for a new location for the reactor farther removed from the populated area, and for better containment of the facility. Because of the preliminary nature of the information presented, the Committee has no basis for arriving at any firm conclusion with respect to these new proposals. However, it can be said that the proposed new location with its approximately quarter mile removal from immediately populated areas is an improvement over the site previously proposed; and, with adequate containment provisions, may prove to be acceptable for a reactor of the general type proposed.

Chairman C. Rogers McCullough did not participate in these reviews or discussions.

Sincerely yours,

R. C. STRATTON,
Acting Chairman.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., August 5, 1958.

Subject: Proposed nuclear power reactor for the city of Piqua, Ohio.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its ninth meeting, August 4, 1958, the Advisory Committee on Reactor Safeguards was given an oral presentation by the Hazards Evaluation Branch of the general characteristics and site of the proposed nuclear power reactor for the city of Piqua, Ohio.

The matter has not been formally submitted to the Committee as yet and no other information has been made available.

The tentative view of the Advisory Committee on Reactor Safeguards is that the site is not a suitable one.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., December 15, 1958.

Subject: Comparison of safety features of: G.E.-Vallecitos boiling water reactor (VBWR); sodium graphite reactor experiment (SRE); Shippingport pressurized water reactor (PWR); Rural Cooperative Power Association reactor, Elk River, Minn.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: The following is in reply to your request for comparison of the standards applied in evaluating the Elk River site with those that were applied in evaluating the Elk River site with those that were applied to the VBWR, SRE, and PWR sites. Pertinent data tabulations are attached. These were furnished by the Hazards Evaluation Branch.

It need scarcely be emphasized that the question of site evaluation is complex. A large number of variable factors, many not strictly comparable from site to site, must be considered. Exact, completely objective, numerical site criteria are difficult to formulate, however convenient and desirable these might be. But the committee attempts to bring a consistent philosophy to the reactor hazards problem and to provide a common basis for site judgments.

Three distinct types of reactor are involved in the group in question. These are of the sodium graphite, pressurized water, and boiling water types.

SRE, a low power (5Mw thermal) reactor of the sodium graphite type, operates at atmospheric pressure in an underground location. The primary coolant is contained in a stainless steel shell which is in turn contained in a sealed concrete structure. Secondary coolant from primary heat exchangers located within the containment structures gives up its heat in external steam boilers. A rupture of the primary system will not cause melting of fuel or release of fission products therefrom. For these reasons, and because the SRE is located in a relatively large exclusion area (1.4 miles minimum radius), immediately surrounded by a sparsely populated district no containment vessel of the type used for pressurized reactors is employed.

The PWR reactor of the pressurized water type is provided with an exclusion distance of approximately 0.5 miles. It is fully contained and provided with biological shielding of the containment structures. It is designed to contain the vapor and energy released in the event of a rupture of the primary water system and one steam generator. In addition, the interconnected containment vessels are designed to contain the energy resulting from significant metal-water reactions.

The VBWR and Elk River reactors are of the boiling water type. In the VBWR the coolant is vaporized and is used for the direct drive of turbo-generators. In the Elk River reactor, radioactive steam is taken to a heat exchanger, providing a barrier. Both are provided with containers designed to prevent release of vapors resulting from a break in the cooling system. The VBWR has been designed to contain the results of a metal water reaction. The Elk River reactor containment vessel is provided with significant missile and biological shielding.

In attempting to decide for a particular reactor whether a given exclusion distance provides adequate protection for public safety, the Committee evaluates design features such as containment vessels, missile shields, biological shields, hydrology, meteorology, and geology, all of which affect reactor safety, particularly when a reactor is located near a populous area. Thus it was felt that the Elk River site would provide an acceptable degree of protection to the public, in view of the isolated primary system and the vapor containment provided. Like considerations were applied in the case of the PWR reactor. The SRE has somewhat less containment, but has a greater exclusion radius than the others mentioned.

Population density is of concern to the Committee. Consequently, the relatively low population density nearby the Elk River site was considered to be a generally favorable element. On the other hand potential growth of the community needs also to be taken into account. The extent of this growth at Elk River is problematical; but the Committee felt it appropriate to express its consideration for the eventuality and to recognize dependence on engineering features for minimizing risk.

The fact that a highway and a railroad run comparatively near the Elk River site is not considered to increase the risk significantly, and conversely acceptance of these features does not imply a reduction in standards of population protection. Since highway and railroad occupancy is transient and intermittent, both the probability and the intensity of the risk are greatly reduced over those applying to stationary, permanent populations at the same distance. Moreover, access to a highway or railroad can be restricted in the event of an accident.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

Site comparison of Elk River and other reactors

	Elk River	VBWR	SRE	PWR
Type	BWR	BWR	Sodium graphite	PWR.
Power	116 TMw	50 TMw	20 TMw	230 TMw.
Containment	Yes	Yes	No	Yes.
Pressure	21 pounds per square inch gage	45 pounds per square inch gage	Conventional industrial building	52.8 pounds per square inch gage.
Leak rate	0.1 percent per day	1 percent per day		0.15 percent per day at 72 pounds per square inch gage.
Criteria	Primary system rupture	Primary system rupture and metal-water reaction.		Rupture of primary system and 1 steam generator.
Hydrology	Mississippi River, 600 feet	No significant factor	Semiarid	Ohio River.
Wind	25 to 30 percent toward Elk River	5 to 9 percent toward Livermore 3 to 6 percent toward Pleasanton	NW.-W SSE.-S	NSW.-WNW. Inversion: SSE.-SE. (valley forms trap).
Distance, site boundary	0.2 mile (excluding highway and railroad).	0.34 mile	1.4 mile	0.3 mile.
Distance to highway	300 feet	0.34 mile	Approximately 3 miles	0.4 mile.
Distance to railroad	250 feet	2 miles	Beyond 2 miles	Less than 0.1 mile.
Nearest residence	Slightly over 0.25 mile	0.34 mile	2 houses within 1.7 miles	½ to ⅝ mile.
Nearest community	Elk River (1,600), 0.5 mile	Pleasanton (2,800) 4 miles	Susana Knolls (750), 2.5 miles	Midland (6,500), 1 mile.
Other towns or cities	Anoka (10,000), 11 miles; Minneapolis 25 miles.	Livermore (10,000), 6 miles	Chatsworth, 6 miles; Santa Susana, 3 miles; Los Angeles, 30 miles.	East Liverpool (25,000), 7½ miles; Pittsburgh, 25 miles.
Nearby facilities	Light industry, Elk River 1 mile	Veterans' hospital 4 miles east	2 small firms under 10 miles, training school 1.8 miles.	1 mile.
Future population	Some beyond 0.25 mile	Agriculture and waste	None under about 2 miles	Some beyond 1 mile.
Population versus distance:				
0.25 mile	0	0	0	0.
0.5 mile	60	(1)	(1)	0.
1.0 mile	700	(1)	(1)	(1).
5.0 miles	7,500		(1)	20,000.
10.0 miles	(1)	22,000	(1)	125,000.

[1] Data not readily available.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington 25, D.C., August 5, 1958

Subject: Rural Cooperative Power Association, Elk River, Minn.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission, Washington 25, D.C.

DEAR MR. MCCONE: At its ninth meeting in Washington, August 4, 1958, the Advisory Committee on Reactor Safeguards considered the submission of the Rural Cooperative Power Association covering a proposed power reactor to be built under invitation as part of the Atomic Energy Commission power reactor demonstration program. Representatives of the contractor and the Hazards Evaluation Branch participated in the conference.

The proposal covers a natural circulation boiling-water-type reactor having 58.2 megawatts (thermal) capacity complete with a supplemental coal-fired superheater of 14.8 megawatts. The design is such that, if proven, the installation may have an ultimate capacity above 100 megawatts. The reactor, which will be provided with containment, is to have fuel elements using a combination of thoria and enriched uranium oxide in stainless steel cladding. The characteristics of the type of reactor are generally well known.

The site selected for this reactor upon property already owned by the cooperative does not now provide a sufficient exclusion distance but this situation is to be improved through the purchase of adjacent land which is State owned. Mutual agreement to this purchase already exists. Even with the increased exclusion distance in the event of a major accident a few persons might be exposed to higher radiation dosage than is considered acceptable.

As a matter of policy the Advisory Committee on Reactor Safeguards considers it not desirable to locate a nuclear reactor of this power level so close to a growing community. However, assuming the containment vessel will provide an adequate factor of safety and will meet the specified leakage rate and that the State-owned land will be acquired, the Advisory Committee on Reactor Safeguards believes that a power reactor of this general type and size may be operated at this site without undue hazard to the public and its property.

This represents some relaxation of previous practice in regard to exclusion distance. In this particular case it appears tolerable because of the present low population density adjacent to the proposed exclusion area and because of the low risk of damage.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

(1) Report No. 58–08813, January 31, 1958—A Proposal for a Nuclear Power Steam Generating Plant for the Rural Cooperative Power Association, Elk River, Minn.

(2) Supplement A to Preliminary Hazards Evaluation of the RCPA—Elk River Site, July 25, 1958.

(3) Supplement B to Preliminary Hazards Evaluation of the RCPA—Elk River Site, August 1, 1958.

(4) Letter from Edward E. Wolter, RCPA, to Milton Klein, Chicago Operations Office, July 9, 1958, with following attachments: Preliminary Hazards Evaluation of the RCPA—Elk River Site, July 9, 1958; Meteorological Estimates for Elk River, Minn., by Special Projects Section, Office of Meteorological Research, June 1958; Hydro-Geological Aspects of the Elk River, Minn., Reactor Site, by E. S. Simpson, geologist (USGS); Excerpt from American Machine & Foundry Co. proposal, "Technical Description of AMF Closed Cycle Boiling Water Reactor Power Plant for RCPA, Elk River, Minnesota," volume I, dated March 22, 1957.

(5) Letter of July 7, 1958, from Dr. Wexler to Dr. Lieberman, and hazard calculations for Elk River, Minn., reactor.

(6) Report to ACRS by Division of Licensing and Regulation on Elk River site evaluation. July 31, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., July 15, 1958.

Subject: Elk River nuclear powerplant.

MR. HAROLD L. PRICE,
Director, Division of Licensing and Regulation,
U.S. Atomic Energy Commission, Washington, D.C.

DEAR MR. PRICE: At its eighth meeting in Washington, July 10–12, 1958, the Advisory Committee on Reactor Safeguards was furnished preliminary information relative to the evaluation of the site for the boiling water reactor to be constructed at Elk River, Minn., by ACF Industries. This reactor is to be operated by the Rural Cooperative Power Association.

The Committee was of the opinion that the information submitted was too meager to serve as a basis for a judgment. For example, the assumptions used in performing the radiation dose calculations are not clear. We all realize that the information was submitted to the Commission so late as to preclude adequate study prior to the Committee meeting.

It is my understanding that an early judgment on the safety aspects of this reactor project at this construction permit stage is desired. I will be happy to arrange further consideration either by subcommittee action or by including this project as an agenda item for the August meeting.

Sincerely,

C. ROGERS MCCULLOUGH, *Chairman.*

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., December 15, 1958.

Subject: Plutonium Recycle Test Reactor.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 11th meeting (November 6–8, 1958), the Advisory Committee on Reactor Safeguards reviewed the design (at its present state of development) of the plutonium recycle test reactor. In addition to the reports referenced below, descriptions of the proposed designs were presented by members of the Hazards Evaluation Branch and representatives of Hanford. Additional clarifying information has been received since that meeting. The views of the Committee are summarized below:

(1) The proposed site appears to be suitable for the proposed facility in view of the power level, the inherent nuclear stability of the active lattice, and the intended containment features.

(2) The proposed scram mechanism is unusual but appears to be adequate.

(3) An untried method for fine control is proposed, but we do not feel that this feature increases the public risk appreciably.

The Committee understands that the design is proceeding toward the following objectives:

(4) The shim rods are to be designed so that the rods will move only when the drive motor is operating. Only one shim rod motor may be run at a time.

(5) Emergency light water cooling for the fuel elements will be applied automatically less than 30 seconds after severe loss of pressure in the coolant system.

(6) To facilitate testing or maintenance, the designers propose that instruments which initiate a scram signal may be bypassed. A bypass which is to be used only when the pile is shut down must be interlocked so as to make operation or startup impossible until the bypass has been removed. In order to bypass such an instrument during operation, duplication of instrumentation must be provided so that the reactor will not operate without proper protective devices.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman.

References:

HW–46461—Plutonium Recycle Program Demonstration Reactor Site Study, November 7, 1956.

HW–48800—Plutonium Recycle Program Reactor Preliminary Safeguards Analysis, July 12, 1957.

HW–48800—(Revised) Plutonium Recycle Test Reactor Preliminary Safeguards Analysis, June 5, 1958.

Hazards Evaluation Branch Report to the Advisory Committee on Reactor Safeguards, October 8, 1958.

U.S. Weather Bureau Comments, September 16, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., November 12, 1958.

Subject: Heavy water components testing reactor.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 11th meeting on November 6, 1958, the Advisory Committee on Reactor Safeguards reviewed the site selection for the heavy water components testing reactor. It is proposed to locate a 60 thermal megawatt, pressurized, heavy water cooled and moderated, testing reactor at the Savannah River plant. Containment is to be provided.

Data concerning the site were obtained from DPST 58–409 et al., Hazards Evaluation Branch summary report, and through oral presentations by representatives of the contractor and by the Hazards Evaluation Branch.

The Committee considers the site proposed, under the conditions of design tentatively presented, including containment, to be acceptable from the standpoint of health and safety of the public.

It is understood that the detailed design features of the reactor when available will be submitted to the Committee for further review.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., October 21, 1958.

Subject: SPERT–III reactor.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: The operation of the SPERT–III reactor was reviewed by the Advisory Committee on Reactor Safeguards on October 15, 1958, at the request of the Division of Licensing and Regulation. The Committee considered both the report of the Division of Licensing and Regulation and the report from the Phillips Petroleum Co., IDO–16425.

SPERT–III is a light water moderated and cooled experimental reactor designed to operate intermittently at pressures up to 2,000 pounds per square inch and temperatures up to 670° F. It is designed for transient studies of pressurized water reactors operating under full power conditions. The SPERT–III program is an extension of the reactor kinetic studies which have been carried out successfully under the SPERT–I program.

The nature of the SPERT–III experimental program is such that this reactor will be operated closer to failure conditions than normal power reactors. The safe performance of these experiments rests largely on the competence of the operating staff. The Advisory Committee on Reactor Safeguards believes that the SPERT staff by performance has shown that it can handle this type of assignment. The Committee commends, and agrees with, the SPERT proposal to avoid running the more hazardous experiments during times of adverse meteorological conditions.

The Advisory Committee on Reactor Safeguards concurs with the Division of Licensing and Regulation that SPERT–III can be operated without undue hazard to the health and safety of the public.

The Advisory Committee on Reactor Safeguards wishes to comment again that the SPERT program is contributing extremely worthwhile information which is basic to many of the safety problems of the entire atomic reactor industry.

Dr. Richard L. Doan excused himself from participation in the discussion and recommendation in this case.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., October 21, 1958.

Subject: U^{233} loading of the materials testing reactor (MTR).

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: The Advisory Committee on Reactor Safeguards reviewed on October 15, 1958, the proposed operation of the materials testing reactor (MTR) with a U^{233} core loading at the request of the Division of Licensing and Regulation.

The Committee had access to the report from the Phillips Petroleum Co., PTR–312, and was briefed by the staff of the Division of Licensing and Regulation.

The Committee agrees with the Hazards Evaluation Branch that the proposed operation of the MTR on a U^{233} core will not endanger the health and safety of the public. Also the Committee is of the opinion that such proposed operation will not expose the adjacent reactor operations to an unacceptable hazard.

In the Phillips proposal, it was recognized that the U^{233} loading will reduce the portion of delayed neutrons. To counteract the effect on the reactor kinetics of this decrease, the worth of the control rod and its rate of insertion will be correspondingly reduced. Also the maximum permissible worth of individual experiments will be reduced to a level compatible with the reduced portion of delayed neutrons. In addition, adequate means for the control of environemental hazards are available. The modifications of the MTR due to the U^{233} loading are very similar to those required for the operation of a plutonium core which has already been successfully carried out.

Dr. Richard L. Doan excused himself from participation in the discussion and recommendation in this case.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 8, 1958.

Subject: The operation of the MTR with plutonium^{239} loading.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: On March 7, 1958, the Advisory Committee on Reactor Safeguards reviewed with MTR personnel and the Hazards Evaluation Branch the proposed special plutonium core for the MTR. In this review the Committee had the benefit of a report by the Hazards Evaluation Branch and report PTR 224 prepared by MTR operating personnel.

The Committee agrees with the conlusion of the MTR personnel that, with the modifications proposed in the control system, the reactor kinetics for the plutonium loading is not significantly different from that of the current uranium^{235}.

It is understood that the plutonium fuel elements will be subject to the same inspection procedure and specifications as the present uranium^{235} element. It is also understood that extensive reactor physics measurements at low power will be carried out in advance of full power operation.

The use of plutonium in the core does not add significantly to radiological problems associated with the fission product burden at the end of the normal operating cycle.

The committee therefore believes that there are no reasons involving matters of safety which indicate that the plutonium loading should not proceed as proposed.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., July 12, 1958.

Subject: A1W reactor.

Dr. WILLARD F. LIBBY,
Acting Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR DR. LIBBY: At its seventh meeting, June 8, 1958, the Advisory Committee on Reactor Safeguards visited the A1W installation at the National Reactor Testing Station. At the eighth meeting, July 11, 1958, the Committee reviewed the data submitted, as referenced below, during a conference with the Hazards Evaluation Branch and representatives of the Westinghouse Atomic Power Division and the Naval Reactors Branch.

The characteristics of the A1W installation differ little from other plants of the same type previously reviewed. The chief hazard is from loss of coolant. Discusstion concerning such possible accidents developed the fact that adequate protection was provided by the fill and charging pumps or by auxiliary coolant water supply through available emergency connections, as indicated in the hazard summary report.

The Advisory Committee on Reactor Safeguards concludes that the A1W component of the NRF may be operated without undue hazard to public health and safety.

While the safety philosophy being developed for the A1W facility at NRTS appears to be adequate for shipboard installation, the fact that there will be several reactors in close operating relationship will require some further review as the project progresses and approaches completion.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:

WAPD–SC–600: A1W Hazards Summary Report, May 1958.
WAPD–187: A1W Plant Description, May 1958.
WAPD–A1W(s)–140: Self-Shutdown Characteristics of the A1W Cores, May 1958.
WAPD–A1W(S)–141: Analysis of Loss-of-Flow Accidents in the A1W Plant, May 1958.
WAPD–A1W(S)–142: A1W Reactor Protection Analysis, May 1958.
WAPD–A1W(S)–143: Analysis of Loss-of-Coolant Accidents in the A1W Plant, May 1958.
WAPD–A1W(S)–159: A1W Project—Meteorology of the A1W Site, May 24, 1958.
WAPD–A1W(S)–146: Analysis of Primary Collant Activity in the A1W Plant, May 1958.
WAPD–A1W(S)–147: Calculation of Doses Delivered From Release of Radioactive Material to the Atmosphere at the A1W Site, May 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., May 12, 1958.

Subject: Brookhaven National Laboratory research reactor (BNL) graphite annealing.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The Advisory Committee on Reactor Safeguards at its sixth meeting, May 9, 1958, reviewed the present status and planned annealing of the Brookhaven National Laboratory research reactor at the request of the Commission.

The Committee had available and examined reports referenced below and had the benefit of discussion with the Hazards Evaluation Branch and a representative of the staff of Brookhaven National Laboratory. In addition the Committee reviewed the report of its subcommittee which considered the problem in detail with representatives of Brookhaven National Laboratory, Division of Reactor Development, Division of Licensing and Regulation, Brookhaven area office, and Oak Ridge National Laboratory, in New York, on April 16, 1958. The Committee had previously been briefed by members of the U.S. team which had visited England and investigated the Windscale incident of October 1957. As supplementary information, members of the subcommittee and Hazards Evaluation Branch reported on the examination of the recent Harwell reports (see reference (3) and (4)) covering the March 1958 annealing of BEPO.

The Committee is pleased that the Brookhaven National Laboratory staff has very carefully reviewed the problem of release of stored energy in the graphite moderator over a period of several years and have more recently, following the Windscale incident, correlated results of their studies with data available from the British. The Committee concurs with the conclusion of the Brookhaven National Laboratory staff that the next scheduled annealing of the Brookhaven Reactor will present no serious hazard to the reactor or to personnel.

Among the reasons which contribute to this conclusion are—

(*a*) Satisfactory annealing of BNL reactor graphite on seven prior occasions.

(*b*) Adequate controls to avoid excessive temperatures and an emergency action program to handle the unexpected.

(*c*) The recent refueling of the Brookhaven National Laboratory research reactor with uranium alloy fuel more resistant to oxidation than the natural uranium fuel previously used.

The Committee commends the Brookhaven National Laboratory staff on their continuing thorough study of problems peculiar to graphite reactors and encourages their future activities particularly along the lines of investigation of irradiated graphite oxidation phenomena.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

References:

(1) Final Report, Stored Energy, Growth, and Annealing Status of Graphite Moderator in the BNL Research Reactor. (Received by ACRS April 11, 1958.)

(2) Report on Graphite Annealing of the BNL Research Reactor by Division of Licensing and Regulation, April 11, 1958.

(3) Manual for the Second Wigner Energy Release, by J. L. Dickson, B.E.P.O., memo 89, Engineering Division, A.E.R.E., Harwell (United Kingdom), March 1958.

(4) BEPO Wigner Energy Release, Preliminary Report, by J. L. Dickson, P.O.C. memo 93, Reactor Services Group, Engineering Division, A.E.R.E., Harwell (United Kingdom), March 28, 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., May 12, 1958.

Subject: Oak Ridge National Laboratory research reactor (ORR).

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The Oak Ridge National Laboratory research reactor was reviewed at the sixth meeting of the Advisory Committee on Reactor Safeguards, May 9, 1958, at the request of the Commission. The Committee, before it received statutory status, had previously submitted its recommendations on location and design of this reactor (reference 1) to the Commission.

For the present review, the Committee had access to information referenced below (2) to (9) inclusive. In addition, representatives from Oak Ridge presented amplifying comments orally.

The physics and engineering of reactors of the Oak Ridge research type are well understood. Considerable operating experience has been accumulated. Moreover, the Oak Ridge staff has demonstrated its ability to operate research and testing reactors.

The Advisory Committee on Reactor Safeguards concludes, in agreement with its initial recommendation and with the Hazards Evaluation Branch, that there is reasonable assurance that the Oak Ridge National Laboratory research reactor can be operated without endangering the health and safety of the public.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

References:

(1) ACRS 5th meeting, April 21–23, 1954; 8th meeting, October 21–24, 1954; 10th meeting, February 3–4, 1955; 11th meeting, March 3, 1955. See letter C. Rogers McCullough to C. K. Beck, January 29, 1958.

(2) The Oak Ridge National Laboratory Research Reactor Safeguard Report, by F. T. Binford, T. E. Cole, and J. P. Gill, October 7, 1954; volume I, ORNL 1794; volume II, TID–10083.

(3) A Method for Disposal of Volatile Fission Products From an Accident in the Oak Ridge Research Reactor, by F. T. Binford and T. H. J. Burnett, August 2, 1956, ORNL–2086.

(4) The Oak Ridge National Laboratory Research Reactor (ORR), a General Description, by T. E. Cole, J. P. Gill, January 17, 1958, ORNL–2240.

(5) Letter J. A. Swartout to H. M. Roth, ORR test operation, February 28, 1958, and attachments.

(6) Dispersion of Airborne Activity From a Cold Cloud Accident to the ORR, by U.S. Weather Bureau Office, Oak Ridge, Tenn., April 9, 1958.

(7) Report to ACRS by Division of Licensing and Regulation on Oak Ridge Research Reactor (ORR), April 15, 1958.

(8) Meteorological Aspects of the Oak Ridge Research Reactor, by Special Projects Section, Office of Meteorological Research, Weather Bureau (Donald H. Pack), April 22, 1958. (Presented at the ACRS meeting.)

(9) Comments on ORR by John F. Newell, April 25, 1958 (presented at the ACRS meeting).

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., May 12, 1958.

Subject: Operation of S3G.

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The S3G General Electric light water-cooled reactor which is to be the prototype of a submarine reactor and which is being installed at West Milton, N.Y., in sections of a submarine hull modified to serve as a containment vessel, described in KAPL–ADM–1310, (reference (1)), has been referred to the Advisory Committee on Reactor Safeguards by the Commission with request for review prior to its operation.

At its 14th meeting in September 1955, this project, then described as SAR, Mark I hull containment, to be used at West Milton, was referred to the former Advisory Committee on Reactor Safeguards for consideration of containment only. At that time the Committee recommended "that the submarine hull, located at West Milton as described, as a container be permitted for the SAR reactor with the understanding that the final reactor and hull design will be such that the maximum credible accident can be contained." Since that time S3G designs for the project have been completed and construction is well advanced.

The Committee has reviewed the design and proposed operation of S3G as described in the references listed below (2) to (7), inclusive, and as amplified in discussion at the meeting with representatives of the General Electric Co., the Naval Reactors Branch, and the Hazards Evaluation Branch. The design incorporates certain experience obtained with several other reactors of this type. Questions raised during the review seem to be operational or items for developmental check and not of a nature to affect safety.

The Committee is of the opinion that there is reasonable assurance that the S3G can be operated at this site without endangering the health and safety of the public.

The Committee considers the careful selection and training of operating personnel by the Navy and the Naval Reactors Branch and the continued surveillance of this project important and a valuable contribution to safety.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

References:

(1) "SAR–1 Hazards Evaluation Summary Powerplant Hull and Site," July 1, 1955, KAPL–ADM–1310.

(2) "S3G Hazards Summary Report," by KAPL staff, March 3, 1958, KAPL–Internal–7.

(3) "Details of Radiological Hazards of S3G," by KAPL staff, March 3, 1958, KAPL–M–SSA–12.

(4) "Report to ACRS on S3G Reactor," by staff of Division of Licensing and Regulation, April 23, 1958.

(5) "Addendum" to (4) by DLR staff, (presented at the ACRS meeting).

(6) Comments by the Division of Biology and Medicine, AEC, on S3G Hazards Summary Report, KAPL, April 12, 1958 (presented at the ACRS meeting).

(7) "Meteorological Aspects of S3G Hazards Summary Report," by Special Project Section, Office of Meteorological Research, Weather Bureau, April 15, 1958 (presented at ACRS meeting).

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 8, 1958.

Subject: Argonne low-power reactor (ALPR).

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: At the request of the Division of Licensing and Regulation, the Advisory Committee on Reactor Safeguards reviewed the design of the Argonne low-power reactor planned for construction and operation at the National Reactor Testing Station.

The Committee had available and examined reports referenced below and had the benefit of discussion with the Hazards Evaluation Branch and the staff of the Argonne National Laboratory.

In view of the low-power level proposed for this reactor, the remote location at which it is to be operated, and the broad experience of the Argonne National Laboratory with boiling water reactors of this type, the Committee agrees with the conclusion of the Hazards Evaluation Branch report of March 4, 1958, that this reactor can be constructed, and operated at power levels up to 3 megawatts, at the National Reactor Testing Station without undue risk to the health and safety of the public.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

References:

(1) ANL–5744.

(2) Letter from C. R. Baum to Martin Biles, February 21, 1958.

(3) HEB Staff Report dated February 3, 1958.

(4) HEB Staff Report dated March 4, 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., January 13, 1958.

Subject: Experimental breeder reactor II (EBR–II).

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The Advisory Committee on Reactor Safeguards heard presentations of the EBR–II reactor by members of the staff of the Argonne National Laboratory on December 19, 1957, during its third meeting. It again considered this reactor on January 10, 1958, during its fourth meeting, and heard the comments of the Hazards Evaluation staff. The EBR–II is a fast, sodium-cooled, heterogeneous power reactor of 62.5 Mw (thermal) designed by the Argonne National Laboratory as a step toward the achievement of an integrated fast breeder fuel cycle. The Committee considered only the enriched uranium loading of this reactor at the present time.

The Committee agrees with the conclusion of the Hazards Evaluation staff that a reactor of this type can be operated at the proposed location in the National Reactor Testing Station without undue hazard to the public.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

References:

(1) Hazard Summary Report Experimental Breeder Reactor II (EBR–II) ANL–5719, May 1957.

(2) Report to ACRS on Reactor Safeguards on Experimental Breeder Reactor II (EBR–II) by Hazard Evaluation Branch, Division of Licensing and Regulation, December 31, 1957.

(3) Addendum to Report of HEB (see reference 2) January 3, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., July 12, 1958.

Subject: The Wahluke Slope.

Dr. WILLARD F. LIBBY,
Acting Chairman,
U.S. Atomic Energy Commission
Washington, D.C.

DEAR DR. LIBBY: At the request of the Atomic Energy Commission, the Advisory Committee on Reactor Safeguards has reviewed the current operational safety of the Hanford production reactors, with particular regard to whether or not these reactors continue to pose an undue risk to those choosing to live on the Wahluke Slope.

Pertinent to this question are the following facts:

(1) The Hanford reactors have been in successful operation for many years without experiencing any incident that created a significant hazard on the slope.

(2) There have been over the years continuing improvements in the design and operation of these reactors which have substantially reduced the probability of serious accidents.

(3) Despite these favorable developments, the Hanford reactors continue to pose potential risks to the public that are greater than those of many other reactors, including the large power reactors now under construction at other locations. The reasons for this are associated partly with the early basic design of the Hanford reactors and partly with their role in national security.

(4) Recent studies have indicated the possibility of effecting a significant additional reduction in potential hazard to the public by improvements in the airtightness of the present reactor buildings and by the provision of suitable filters that will permit better confinement of any radioactive products that may be accidentally released from the reactors.

After careful consideration of all known factors affecting the overall safety of the Hanford operation, and to the things that have done and can still be accomplished to reduce the hazard to the public, the Committee has arrived at the following conclusions:

(A) While distance from the reactors offers no certain protection against the radioactivity that may be released in a reactor accident, it does provide an important factor of safety which should always be preserved at Hanford by the permanent retention of the exclusion area known as the primary control zone.

(B) The settlement of the Wahluke slope, to the extent that it attracts settlers from distant locations, will expose increasing numbers of people to the possible consequences of a reactor accident.

(C) The risks of living on the slope, while not negligible, are significantly less than they have been in the past and are presently not much greater than those existing at more distant locations.

(D) The positive values to be expected from various degrees of building confinement as described before, while promising, have not yet been fully evaluated. Until the advantage of partial confinement in reducing the hazards to the Wahluke slope and other areas has been adequately resolved, the Committee feels that the status of the secondary zone should remain unchanged.

(E) As soon as it is firmly established that confinement, which will offer adequate protection, can be achieved and a decision is made to proceed with such installation, the secondary zone could be released at once, since population growth in the area will be slow in the first few years.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., December 15, 1958.

Subject: The Wahluke slope.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At the request of the Atomic Energy Commission the Advisory Committee on Reactor Safeguards summarizes its views with respect to the proposal to remove restrictions which have heretofore limited the development of the so-called secondary zone of the Wahluke slope as an agricultural area.

The program, which the Commission has underway, increasing the degree of confinement of fission products in case of accidents to the Hanford reactors will substantially decrease the hazard to the occupants of the Wahluke slope. After these changes have been completed, the risk from the reactor plant to the health and safety of occupants of this area should be low enough to allow normal use of the secondary zone. Since it is expected that the population growth in this area will be slow in the first few years and the changes will be completed in this time the secondary zone may be released now.

Pertinent to this question are the following facts:

(1) The Hanford reactors have been in successful operation for many years without experiencing any incident that created a significant hazard on the slope.

(2) There have been over the years continuing improvements in the design and operation of these reactors which have substantially reduced the probability of serious accidents.

(3) Despite these favorable developments, the Hanford reactors continue to pose potential risks to the public that are greater than those of many other reactors, including the large power reactors now under construction at other locations. The reasons for this are associated partly with the early basic design of the Hanford reactors and partly with their role in national security.

(4) Recent studies have indicated the possibility of effecting a significant additional reduction in potential hazard to the public by improvements in the airtightness of the present reactor buildings and by the provision of suitable filters that will permit better confinement of any radioactive products that may be accidentally released from the reactors.

After careful consideration of all known factors affecting the overall safety of the Hanford operation, and to the things that have been done and can still be accomplished to reduce the hazard to the public, the Committee has reasoned as follows:

(A) While distance from the reactors offers no certain protection against the radioactivity that may be released in a reactor accident, it does provide an important factor of safety which should always be preserved at Hanford by the permanent retention of the exclusion area known as the primary control zone.

(B) The settlement of the Wahluke slope, to the extent that it attracts settlers from distant locations, will expose increasing numbers of people to the possible consequences of a reactor accident.

(C) The risks of living on the slope, while not negligible, are significantly less than they have been in the past and with the proposed changes in confinement will not be much greater than those existing at more distant locations.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman.

APPENDIX E

REPORTS TO THE COMMISSION BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS CONCERNING DEPARTMENT OF DEFENSE REACTOR PROJECTS

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., November 12, 1958.

Subject: S4G (*Triton*).

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At its 11th meeting on November 7, 1958, the Advisory Committee on Reactor Safeguards considered the safety features of the S4G nuclear reactor powerplant of the submarine *Triton*.

This plant consists of two parallel, heterogeneous, pressurized, water-cooled independent reactors. The S3G single reactor, prototype of the S4G is now in operation at West Milton, N.Y.

Information available for review was supplied orally by representatives of the Naval Reactors Branch, General Electric Co. and Hazards Evaluation Branch, and in reports listed below.

In view of the satisfactory operation of the prototype S3G, and the care exercised by Naval Reactors Branch and the Navy in construction, operation, and personnel training, the Committee foresees no undue hazard to the safety or health of the public in the operation of the S4G, other than that possibly introduced by unusual fleet operations.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

References:
KAPL–Internal–18.
HEB Staff Analysis.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., August 5, 1958.

Subject: Lockheed radiation effects reactor (RER).

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: The Advisory Committee on Reactor Safeguards at its ninth meeting on August 4, 1958, reviewed for the first time the Lockheed radiation effects reactor (RER) proposed for operation at Air Force plant No. 67 near Gainesville, Ga. This a 10-megawatt water moderated and cooled enriched uranium reactor which will be used in an unshielded position to irradiate large aircraft components with fast neutrons and gamma rays. The operators will be protected by a shielded control room. For protection of the public, reliance is placed exclusively on distance as maintained by a rigidly controlled exclusion area. The reactor will be lowered into a pool of shielding water when it is not in operation.

Since the proposed reactor is of a type that has been operated successfully elsewhere, the Committee feels that purely from the viewpoint of its operation no especially troublesome problems should be encountered. However, there are two elements of risk to the general public in the proposed operation that do not exist in the case of other reactors operating at similar power levels. The Committee is not prepared to say that the risk is large or unacceptable but it certainly is not negligible. In operating an unshielded reactor at the proposed 10-megawatt power level a substantial quantity of carbon 14 and other radioisotopes will be formed in the surrounding atmosphere and soil. Some of this undoubtedly will be scattered around locally, especially if high winds or a tornado should sweep the area. The second element of risk stems from the fact that if a nuclear excursion, followed by a metal-water reaction, should occur when the reactor is

suspended in its unshielded location the scatter of the fission products probably would be considerably greater than would be the case for a similar reactor surrounded by a heavy concrete shield. No containment of any kind is provided in the proposed reactor operation.

If the additional risks entailed in operating a reactor at substantial power in an unshielded position are compensated by the prospect of getting important information that cannot be obtained by safer methods than, in the presentinstance, these additional risks may be considered acceptable. Within its limited knowledge of radiation damage effects the Committee is doubtful that the benefits of irradiating large-scale aircraft components will compensate the additional risks of doing so by the proposed method, but is willing to defer to superior judgment in this regard.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman.

References:

(1) LAC 147, Radiation Effects Reactor Safeguards (Hazards Summary Report), 15 January 1958.

(2) Lockheed Nuclear Products Emergency Manual AFP No. 67, May 1958.

(3) Memorandum of July 16, 1958, to Lieutenant Colonel Fisher, AEC, from Capt. John E. Lineberger, RDZNMN, Marietta, Ga. Subject: Transmittal of Meteorological Data.

(4) Wind Rose charts (5) for REF Valley, 2 July 58, C. R. Englund, Area Monitoring Stations.

(5) LAC-RER Maximum Credible Accident Calculation Method (2 pp., undated) by Georgia Division, Lockheed Aircraft Corp.

(6) RER Operating Permissives for Over Flying Aircraft (2 pp., undated) by Georgia Division, Lockheed Aircraft Corp.

(7) Argon Dose in a Finite Volume (4 pp., undated) by Georgia Division, Lockheed Aircraft Corp.

(8) The Problem of Argon Diffusion of the Radiation Effects Reactor (8 pp., undated) by Georgia Division, Lockheed Aircraft Corp.

(9) Report to ACRS by Division of Licensing and Regulation on Lockheed Radiation Effects Reactor (RER), July 25, 1958.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., August 5, 1958.

Subject: S5W Powerplant.

Hon. JOHN A. MCCONE,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. MCCONE: At the request of the Atomic Energy Commission, the Advisory Committee on Reactor Safeguards reviewed the S5W reactor plants at its eighth meeting on July 11, 1958. The Committee has had access to the reports referenced below and, in addition, has discussed the associated problems with representatives from the Hazards Evaluation Branch, the Naval Reactors Branch, and representatives of Westinghouse Atomic Power Division.

The S5W powerplant is a pressurized water reactor having [deleted] thermal power and is designed for installation in a series of submarines. The Navy proposes to construct these submarines at five locations: New London, Conn.; Portsmouth Naval Shipyard, Kittery, Maine; Mare Island Naval Shipyard, Vallejo, Calif.; Ingalls Shipbuilding Corp., Pascagoula, Miss.; and Newport News, Va. It is intended that these submarines will join the fleet and make entry into other ports.

The Advisory Committee on Reactor Safeguards believes that the S5W plant is at least as safe as those in existing nuclear-powered submarines. In fact, this series of powerplants probably represents an improvement in safety over previous designs because the S5W design has been developed on the basis of more extensive background. The operability of the pressurized water powerplant has been demonstrated in the *Nautilus* and in additional thorough experimentation at the Naval Reactor Facility (NRF). The design experience gained from these reactors and the *Skate* plants, plus the special experiments at NRF, have led to a better understanding of the response of this type of powerplant to abnormal conditions. The Naval Reactors Branch has demonstrated its ability to monitor the design

and construction of nuclear-powered vessels and to develop well-trained operating crews.

The Advisory Committee on Reactor Safeguards, however, wishes to point out that nuclear power ships are not completely free from presenting a possible hazard to the public. There exists an ever-present low-level risk of release of radioactivity. Because of this, the Committee is concerned by the absence of experimental data on the flushing characteristics and local meteorology for the primary harbors into which nuclear vessels will enter. Although there are, at present, no data which would suggest the exclusion of nuclear vessels from the ports at which these S5W submarines will be constructed, at the same time there is not sufficient information to judge adequately the magnitude of the cleanup problem should a large release of fission products occur. In view of the projected expansion of the number of nuclear-powered vessels, the Committee recommends that steps be initiated to obtain this information which, because of its complexity and long-time scale, will require a long leadtime for development.

The Committee reiterates that the prime assurance of safety during building, operating, and repairing nuclear ships at various locations depends upon the proper prior evaluation of potential hazards. This must be done for each new situation and at present, on a case-to-case basis, by persons having a detailed knowledge of the factors influencing reactor safety. This requires that the training of officers and crews of nuclear ships must continue to emphasize knowledge of reactors and reactor safety. It also means that the experience and technical judgment of the Naval Reactors Branch must be utilized to the maximum extent in evaluating such operations. The problem assumes increasing importance as the number of nuclear-powered ships increases.

Sincerely yours,

C. ROGERS MCCULLOUGH, *Chairman.*

S5W references:

(1) WAPD–SC–515—Summary Report on the Reactor Hazards Associated with the Operation of the S5W Reactor Powerplant Utilizing Core 1, April 1, 1958.

(2) Memorandum from W. K. Davis to H. L. Price, May 1, 1958. Subject: Reactor Hazards Report on Operation of the S5W Reactor Powerplant.

(3) WAPD–S5W–PP–334—S5W Reactor Plant Hazards: Accident and Protection, April 1958.

(4) Meteorological Aspects of Nuclear Submarine Operation, by U.S. Weather Bureau, February 21, 1958.

(5) Comments on WAPD–SC–515 by U.S. Weather Bureau, May 27, 1958.

(6) WAPD–S5W–755—Reactor Hazards Summary—S5W Core 2, June 24, 1958.

(7) Memorandum to C. K. Beck from T. Rockwell, April 23, 1958, with following attachments: (1) Meteorological estimates for Portsmouth, N.H., and Mare Island, Calif., April 1958; (2) Flushing of the Thames River and Block Island Sound, July 1954.

(8) Report to ACRS by Division of Licensing and Regulation on S5W Powerplant, June 17, 1958.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 8, 1958.

Subject: *Skate* and Follow Ships—References.[1] [2] [3] [4]

Hon. LEWIS L. STRAUSS,
Chairman, U.S. Atomic Energy Commission,
Washington, D.C.

DEAR MR. STRAUSS: The problems on construction, testing, and operation of nuclear-powered submarines were considered by the Advisory Committee on Reactor Safeguards on March 6, 1958. The discussion was based on information furnished through documents as listed and oral presentations by representatives of the Naval Reactors Branch and the Hazards Evaluation Branch.

Mare Island, Calif., and Portsmouth, N.H., Navy Yards.—The problem of the construction, testing, and operation of two submarines each at these Navy yards and in particular the relation of the environmental features was discussed.[5] The

[1] WAPD–SC–514.
[2] WAPD–SFR–1156.
[3] Staff Report (HEB), Jan. 27, 1958.
[4] WAPD–SFR–A–1790–T.
[5] Letter, Admiral Rickover to C. K. Beck, Mar. 4, 1958.

ACRS considers it essential that the flushing effect of the harbor waters and the meteorology of these areas be documented and compared to the conditions at New London, Conn.

Submarine operation.[6]—The ACRS has received OPNAV 03000.5,[7] BUSHIPS 9890.4,[8] and BUPERS 1540.38.[9] It is sympathetic to the position taken in which nuclear safety is to be insured primarily by the action and decisions of personnel trained specifically to deal with nuclear systems and their hazards.

The Committee endorses the present Navy practice to consult with and to be guided by the Naval Reactors Branch regarding reactor safety and operational procedures for nuclear-powered ships. It considers this practice to be important and urges its continuance.

To maintain the present admirable safety record of nuclear-powered ships, the Committee emphasizes the importance of keeping to a minimum consistent with military necessity the number of ports which nuclear-powered naval ships may enter, pointing out that as the number of nuclear-powered ships increase, consideration should be given to the designation of ports or bases where multiple berthing may be permitted.

Cold water accident.[10]—The Committee has noted that in the case of *Skate* and ships with a similar powerplant design strong reliance is placed on operational control to prevent a cold water accident. The Committee encourages the Naval Reactors Branch in their development of a protective system which will give additional safety control without sacrifice of reliability.

Sincerely yours,

C. ROGERS MCCULLOUGH,
Chairman, Advisory Committee on Reactor Safeguards.

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[6] Letter, Admiral Burke to L. L. Strauss, Jan. 21, 1958.
[7] OPNAV 03000.5.
[8] BUSHIPS 9890.4.
[9] BUPERS 1540.38.
[10] WAPD–S3W–4.

U.S. ATOMIC ENERGY COMMISSION, ADVISORY COMMITTEE ON REACTOR SAFEGUARDS ADDENDUM TO REPORT TO THE JOINT COMMITTEE ON ATOMIC ENERGY ON OPERATIONS UNDER SECTION 170 OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED

The following is a summary report of the functioning of the Advisory Committee on Reactor Safeguards which was created by the Indemnity Act, Public Law 85–256, on September 2, 1957. The period covered is from January 1, 1958, through March 31, 1959.

The Committee was represented in appearances before the Joint Committee on Atomic Energy on two occasions during this period. In the first instance, on February 20, 1958, Dr. C. Rogers McCullough, the chairman, accompanied by Vice Chairman Reuel C. Stratton and Dr. Abel Wolman, reported upon the functioning of the statutory Advisory Committee on Reactor Safeguards from its inception until that time. In May of 1958, Dr. McCullough, accompanied by the full membership of the Committee, appeared before the Joint Committee on Atomic Energy and discussed in further detail the functioning of the ACRS, the necessity for its access to information, and the advisory nature of its statutory responsibilities.

During the period from January 1958 through March 1959, the Committee held 11 meetings. It reviewed and furnished letter advice to the Commission on the following reactor projects. The unmarked items are those upon which the ACRS has responded to requests for advice and upon which no further action is presently planned. The items marked with an asterisk are at various stages of consideration by the Advisory Committee on Reactor Safeguards prior to final advice regarding an operating license or its equivalent.

Massachusetts Institute of Technology
Yankee Atomic Electric Co.*
Commonwealth Edison reactor (Dresden)*
Consolidated Edison reactor (Indian Point, N.Y.)*
General Electric Vallecitos boiling water reactor
General Electric test reactor
Westinghouse testing reactor
Carolinas Virginia Nuclear Power Associates (Parr Shoals, S.C.)*
Rural Cooperative Power Association (Elk River, Minn.)*
City of Piqua (Piqua, Ohio)*
Hanford production reactors (including new production reactor)*
Savannah River production reactors
Nuclear Merchant Ship (N.S. *Savannah*)*
Argonne low-power reactor
Plutonium recycle test reactor*
Heavy water components test reactor*
EBR–II (experimental breeder reactor)*
SPERT–III (special power excursion reactor test)
Oak Ridge research reactor

Brookhaven National Laboratory research reactor (graphite annealing)
Materials testing reactor (Pu and U^{233} loadings)
Nine military program reactor projects

It is the Committee's understanding that, for cases subject to the licensing procedure, the letters of advice which it furnishes are introduced into the public record by the staff of the Commission in conjunction with publication of the notice of hearing and again at the hearing.

The Advisory Committee on Reactor Safeguards is currently engaged in a review of the methods it uses to examine and advise upon the safety of nuclear reactors. The Committee is examining the extent to which it can study in detail the problems upon which it advises. The Committee will be prepared to discuss its views on these matters at a later date.

The Advisory Committee on Reactor Safeguards has devoted a considerable amount of time to the problem of furnishing advice on site criteria. This is a complex problem. Its solution should have a rational basis in order that it can be adapted generally and in order that the criteria will be self-consistent. Several promising approaches have been discussed with the staff of the Commission and are being explored by the Committee.

C. Rogers McCullough, *Chairman.*
J. B. Graham, *Executive Secretary.*

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